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CONTENTS

EDITORIAL:
Editorial Notes 233
Indicting Common Sense 235
The Limit of the Commission's Authority 236
LETTERS TO THE EDITOR:
Safety Appliance Inspectors 237
Base Failures in Rails 237
MISCELLANEOUS:
Transportation of Fruit and Vegetables; by E. D. Levy 239
*Narrow Gage Gasolene Motor Car 242
Results of Public Ownership in France; by Yves Guyot 243
*An Analysis of Steel Ingot Manufacture; by Bradley Stoughton 245
Terminal Service; by W. M. Prall 249
*Results of Comparative Firebox Tests 251
Regulation of Railways; by W. W. Finley 253
*A Pilot Snow Plow; by E. R. Lewis 255
Accident Statistics for 1910 256
Foreign Railway Notes 238, 244, 250, 256
GENERAL NEWS SECTION 257

*Illustrated.

LIKE nearly all papers discussing the defects in current steel rail manufacture written recently, that by Bradley Stoughton, printed elsewhere in this issue, goes directly to the ingot. Metallurgists in general have realized for some time that the ingot is the source of most of the defects giving rise to the troubles with rails, and it is because of this that they are attaching so much importance to the ingot. Papers by Captain Hunt, Benjamin Talbott and others, published in these columns recently, also refer to the ingot problem. It is understood that the rail committee of the American Railway Engineering Association will this year report that the present specifications requiring that tests be made from three ingots of each heat is sufficient, giving little credence to the individuality of the ingot, and this in spite of the fact that more than half the defects in rail manufacture, and these the most serious, are defects in the ingots. Mr. Stoughton believes that to have sound rails it is necessary to have sound ingots, and his requirements for sound ingots are severe. It is not many years since if steel showed by analysis the desired chemical composition, and the ingot had been cropped to remove piping and pronounced segregation, it was readily accepted. In addition to these defects Mr. Stoughton calls attention to the danger of blow holes, and of sulphide of manganese and other impurities. Analyzing for oxygen or nitrogen was unheard of until recently; no consideration whatever was given to these elements. It is now known that they have a very injurious effect on the qualities of the steel. This entire discussion emphasizes the close scrutiny which every step in the process of steel making, as well as the final results given by the finished product in service, are receiving.

THAT pools to maintain the price of rails did exist is now an accepted fact. W. E. Corey, former president of the United States Steel Corporation in his testimony before the special examiner in the government's suit against the Steel Corporation, dispelled what doubts there had been. Mr. Corey said that the existence of this "arrangement" first came to his knowledge in 1901, when he was made president of the Carnegie Steel Company, before the organization of the Steel Corporation. This pool was broken up in 1904 or 1905, and since that time there has never been any agreement to advance, reduce or maintain the price of that product. The testimony showed that the agreement was not always strictly adhered to by the different manufacturers, and that in 1903 the Tennessee Coal & Iron Company was selling its open hearth rails at $2 above the agreed price. Since the breaking up of the pool certain independent companies have wanted to raise the price, but the officers of the Steel Corporation were decidedly against it, and their stand exerted a deterrent influence. The witness added that the corporation could make rails more cheaply than its competitors. His statements were straightforward and fair and, while a trifle vague at times, never evasive. They are considered damaging to the Steel Corporation, and it has even been said that they are typical of what is said by those who had been in the business but are now out of it. The testimony shows, however, that about one-fourth of Mr. Corey's fortune is invested in the securities of the corporation, and also that he is opposed to the government's suit; so the argument loses its force. Just what influence the testimony will have on the case is a matter of conjecture. The fact remains that it indicates that though the Steel Corporation was in the pool, the pool had been in existence before the corporation and that it was subsequently abolished; also, that if the corporation now indirectly fixes the price of rails, it keeps it down as well as up.

ALTHOUGH a part of a scheme of government the administration of which is controlled chiefly by political considerations, the Interstate Commerce Commission has remained a non-political body insofar as partisan politics are concerned. Except for the fact that the law provides that no more than four of the commissioners shall be of the same political party there has been no occasion for even recognizing their party membership. While the railways have frequently been the victims of party politics, as when one party or another has tried to make capital for itself by advancing some proposition for railway regulation as an issue, the principles of the republican, democratic or progressive parties have had little to do with the matter. Certainly, they have nothing to do with the determination of the reasonableness of rates. It is, therefore, peculiarly unfortunate that the leaders of the democratic party, now in power in Congress, should have allowed their zeal to recoup themselves from the patronage of the new administration for the long, lean years that have passed, to involve the appointment of an interstate commerce commissioner. E. E. Clark, whose term expired on December 31, was renominated by President Taft. Confirmation of the appointment has been held up along with a number of others which may be given to loyal democrats after March 4.

Not only has Mr. Clark come to be regarded as one of the ablest and fairest members of the commission, but it has long been the consensus of opinion among those who have been most concerned with its work that the experience gained during service on the commission should argue most persuasively in favor of repeated reappointments. Membership on the Interstate Commerce Commission is not a sinecure to be used as a reward for political services. The commission's responsibilities are greater and its work more arduous than those of almost any other department of the government, while its duties are too important to be interfered with by considerations of political partisanship. If the appointments of the members of the commission are determined by partisan considerations, it will not be long before their acts are determined by similar considerations. The success of regulation of railways depends vitally on preventing this. By withholding confirmation of Mr. Clark's nomination the Senate is acting in a way that is unjust to him, disgraceful to it and fraught with public danger.

GOVERNMENTAL investigation of railway practices affecting safety, which, unhappily, is still a useful function in every state, seems lately to have been considerably improved; and this is true notwithstanding the fact that there is much lost motion in the machinery which is engineered from Washington. A fine piece of work done by the Albany (New York State) commission was noticed in these columns last week; an example of governmental regulation which may well serve as a model. The Illinois Railroad and Warehouse Commission pointed out the need last August (*Railway Age Gazette,* August 16, p. 290) in its report on the Western Springs collision, when it uttered the significant truth that investigations confined to one accident and its immediate causes produce no permanent good results; that "we should go much further, determine real causes and devise some plan to prevent" those accidents of which so many, due to the same class of causes, follow one another year after year. The Louisiana commission in its report on the collisions at Montz, and at Alexandria, brought out in lucid fashion important facts which have instructive bearings on accidents everywhere. The Connecticut commission silenced unreasonable public clamor about alleged unsafe tracks at Westport and Green's Farms. The Indiana commission, in its brief order concerning switch lights, exposed a weakness which exists, with great potential danger, in a thousand places. The Interstate Commerce Commission's report on the Indiana collision brought out a chain of facts of a kind which, though always instructive to railway men everywhere, are rarely printed for the general benefit except as the State unearths them. It will be noted that in all these reports the one most important thing, the improvement of discipline, is dealt with only in a general way. The governmental authorities see what needs to be done in this direction, but they do not tell us just what to do. This is significant. But this silence concerning details should be as loud an admonition as any multiplication of words could be. *The task is up to the railroads.* The writer of that Corning report plainly has a very definite idea of what ought to be done to make enginemen as highly efficient as possible, but he does not describe the procedure. And why should he? Every competent superintendent knows, also.

FROM 65 to 80 per cent. of the damage to freight cars is caused by defective draft gears. This is a statement made by a master car builder of a large road who has carefully checked the performance of freight cars of exactly the same capacities and design, but equipped with different types of draft gear, and in sufficient numbers to enable a fair comparison to be made. While it is true that these figures cover only the repairs which were made on the home road, the large number of cars considered insures the proportion being fairly accurate without taking into consideration the repairs which might have been made on foreign lines, and which it would not be possible to check. Some of the draft gears give very much better results than the others, but we are only at liberty to say that generally speaking the gears of the higher capacities and greatest travel gave the best results. The Master Car Builders' Association has made extensive draft gear tests in the past, including so called static tests in a testing machine which applied and released the load gradually, and drop tests, which allowed a weight or tup to fall and strike the gear at a comparatively high velocity. Neither of these tests approximate service conditions, and efforts have been made by both the railroads and the manufacturing interests to develop an apparatus for testing the draft gear, which would provide conditions more like those in actual service. While a fairly close approximation may have been had to this, still it is true that the Master Car Builders' Association has never had any tests on such apparatus made under its supervision, and after all the behavior of the gears in actual service under the great variety of conditions encountered is what really counts; every effort should therefore be made to determine the service results as accurately as possible. Unlike a locomotive a car sometimes receives as great an amount of repairs on a foreign road as at home and this is what complicates the situation. However, there must be a number of roads which have just as favorable conditions as the one mentioned above and it should be possible for the association to secure and place on record more authentic data on this subject than now appears in its proceedings.

THE investigation by the Interstate Commerce Commission into the practices of the railways in the issuance of free transportation should be, and apparently is being, received by railway officers with gratification. The testimony of railway men at the hearing in Denver before Commissioner Harlan showed no reluctance to tell the facts. It was full and candid, and manifested a disposition to co-operate with the commission in abolishing a bad practice. It may be considered strange that the commission selected as the place for its first hearing a state in which the railways already had taken advantage of an indictment against them for giving state passes to interstate shippers to put a stop to a practice which had got beyond their control. But it is possible that the cumulative disclosures made in Colorado following the effort of the Department of Justice to have the issuance of state transportation to interstate shippers pronounced illegal may create a public sentiment that will result in the passage of a state anti-pass law. The railways have frequently advocated state anti-pass legislation, and would have been even more urgent but for their appreciation of the danger of offending the politicians who have used most of the passes. The public has failed to grasp the fact that railways as corporations have no inherent fondness for throwing away money in the form of free transportation and rebates, and that even the genial general passenger agent, who is popularly supposed to derive his greatest pleasure in life from handing out passes is more interested in presenting a good showing in the passenger revenue statement. Even the freight solicitor long ago discovered that the efficacy of the pass as a means of capturing carload shipments is diminished or destroyed when his rival also has passes to distribute. Whatever benefit railways may have derived from the issuance of passes has been largely the negative one of averting the ill will that might have followed their refusal, or of offsetting the effect of such extension of favors by a competitor. Even the good will that may have been gained by judicious pass distribution has been more than balanced by the disfavor created among those to whom passes have been denied. The pass that is refused always looks bigger than the one that is given. While the effect of the federal anti-pass law has undoubtedly been felt in an increase of anti-railway legislation, many a railway officer experienced a profound sense of relief when the privilege of indiscriminate pass-giving was taken away. It behooves the railways in the present case to aid the commission in its investigation to the best of their ability.

THE new Grand Central Terminal, New York City, was opened last Sunday, and a seven years' task of the first magnitude was substantially completed, with great credit to all concerned. We do not mean by this that the station is finished, for there is much yet to be done; but the perplexing problems of construction and operation are out of the way, all of the most important features of the station are in use, and the architects' work is before the public for its judgment. The salient elements of this work are the arrangement of the rooms and the decorative design of the great upper concourse. New Yorkers naturally make their comparisons with the Pennsylvania station, about a mile away, which was finished two and a half years ago. As to arrangement, both designs have marked merits, and we shall not attempt to make a critical estimate of either. The only way to make an accurate comparison would be to measure the aggregate of the foot journeys of all the passengers for a day or a week—journeys necessarily long, as compared with those at a station of moderate size—which is hardly practicable. At the Grand Central a passenger entering at the main central front entrance, on Forty-second street, reaches the train level by three short and easy descents. Between these are long level stretches, making the journey in the opposite direction easy. From the lower level, used by the thousands of suburban passengers, the ascending journey is not so easy. But the inward stations, where the suburbanites will mentally formulate their criticisms each morning are not yet finished and the details of this feature are yet to be made known. The arrangement of the rooms, could not be more simple. The baggage room (on the level of Forty-fifth street) is seventeen feet higher than the ticket office floor, and is entered through the north gallery; but passengers have little or no occasion to go there (unless they go in their carriages to deliver trunks) for the baggage checkers are close to the ticket office and send and receive checks through pneumatic tubes. From an esthetic standpoint, the Grand Central headhouse will undoubtedly receive general commendation. The decorations, both outside and in, are not only beautiful but rich; yet no more so than is justified by the vast size of the structure, and by the perfection of its details as a mere building. The outstanding quality of the Pennsylvania station is dignity, with almost a suggestion of coldness; this is the main difference between the two structures. The design of the arched ceiling of the main concourse at the Grand Central, a hundred feet above the observer, is bold and unique; a blue sky over which are spread figures, in delicate gold tracery, showing the signs of the zodiac, with hundreds of other stars, some of which are made real by little electric lights placed behind them. This feature alone would make the station one of the sights of the city. From a figurative or mental standpoint (as well as physically) this decoration will be far above the heads of the great majority of the passengers, and their only sensations will be awe and wonder. But those who take an interest in stars and other celestial things will, no doubt, commend the astronomer and the mystic who, with the architect, have combined to produce a most striking effect; an effect as far removed from concrete bridges and coal burning freight engines as could possibly be imagined.

LOGAN G. McPHERSON has described, in the *North American Review* for January, the concerted movement of the railways to give the public correct information regarding their business which resulted in the establishment of the Bureau of Railway Economics, of which Mr. McPherson is director. The need for scientific gathering and analysis of railway data was shown by persistent and general misstatements regarding rates, capitalization, accidents, etc., over a long period of years, and the want of readily available material for refuting these misstatements. The railway managers felt confident that their business methods and the results would bear the most searching scrutiny and thorough discussion, if fairly done. They were aware that there were conditions existing and things done that could not be defended, but they were sure that the number of things done and conditions existing that could be defended and that merited public favor and commendation greatly preponderated. When the bureau was created the committee of six railway presidents supervising its work instructed it to get and print the facts, all the facts and nothing but the facts. This policy has been followed in the bureau's studies of valuation, capitalization, rates, wages, earnings, water transportation, etc. Its various bulletins have been valuable contributions to the scientific information regarding both our railways and those of other countries. There has been some complaint that, as has been said, they are rather dry reading, and therefore do not appeal to the popular reader. Cold facts are dull things, and it is a difficult art to make their accurate presentation interesting to the man in the street. Fortunately, in the long run, the process of educating public opinion begins, not with the man in the street, but with the man in the professor's library, the editor's sanctum, the business office and at the statesman's desk. Knowledge and ideas work, not upward from the man in the street, but downward to him from the classes mentioned, and the professor, the editor, the business man and the statesman will consume stronger meat and with less sensational seasoning than he will. The bureau's bulletins are adapted to consumption by these classes, although perhaps a little more seasoning would make them no less instructive and palatable to more people. The professor, the editor, the business man and the statesman may not transmit to others in detail the information they give, but they do afford material for thinking and discussion by these persons which are bound to influence public opinion, and thereby public action. The bulletins also furnish information that can be effectively used by railway men in the discussion of railway matters. Their greatest merits have been that the controversial tone has been absent and that so far as we know they have never contained a statement that could be refuted. That they have exerted influence is beyond question, for much of the data given has been widely published in the newspapers, and has been used by professors of economics in universities, etc. It was a wise inspiration that moved the railway presidents to provide for this work. The amount of it should be increased. The bureau is furnishing much good ammunition; there ought to be more railway people using it. The good of the railways and the good of the public demand that the truth about railway matters shall be stated with tireless iteration and reiteration in every part of the United States. When what is true is told as persistently and generally as what is false has been told over a long period of years, conditions will be much improved. The public means to act fairly. It has in many cases acted unfairly, because it has been misled as to what was fair. The only way to keep it from being misled in future is to keep on telling the facts, all the facts and nothing but the facts.

INDICTING COMMON SENSE.

THE grand jury that is investigating the New England railroad situation continues from time to time to indict President Mellen of the New Haven, and President Chamberlin of the Grand Trunk. Every time it indicts them it also indicts common sense. It indicts economy and efficiency in railway operation. It indicts the economic opinion of the age. Either that, or it indicts the Sherman anti-trust law, the Congress that passed it, the Congresses that have failed to amend it, and the public opinion that has elected and sustained these Congresses. The *Railway Age Gazette* has already commented on the relations of the New Haven and New England (December 20, 1912, page 1171). We are here concerned with the question of a competitive railroad system in New England versus a co-ordinated, unified one.

Competition was to be produced by the construction by the Grand Trunk of the Southern New England into a territory practically all of which was already well supplied with mileage. The new line for a long time would have been a bridge across

New England. It would have been expensive to build. It would have lacked adequate feeders. It would have had few tracks into industries. Therefore, it would seem that it would long have been unprofitable. President Hays of the Grand Trunk thought it desirable to build it. President Chamberlin, who succeeded him, did not. He believed it better for the Grand Trunk to get in over the New Haven's tracks. If the Southern New England should be built, there would be a new railroad which the traffic of New England would have to support. It is fairly obvious that it costs more to support two railways than one. If a railroad opens new territory the traffic created, and which otherwise would not be developed, will support it. If it enters old territory already having a large mileage of railway it must live by attracting traffic already moving, or that would move, by the existing lines. In the former case it renders a public service. In the latter case it causes economic waste. The Grand Trunk extension seems, in the main, to fall within the latter category.

There are some things that would be worse than excessive railroad competition and the economic waste that it causes. One of these would be an unregulated railroad monopoly which was inefficiently managed, was arbitrary with the public and gave it poor service for which it charged high rates. The New Haven is not inefficiently managed. Its rates are not excessive. It is not unregulated, and if the public interest requires further regulating of it, this can be done. Its management has been somewhat arbitrary, but regulation and public opinion can curb this. Its service has been good in most ways and deficient in others, but will not be improved by its dismemberment. On the contrary, the railway service of New England will not be made the best it can be, or, in the long run, improved at all, by breaking up the New Haven system and developing general competition. The best service can be secured at the least cost by completing the co-ordination and unification of the existing New England railroad system. These things would make it practicable to adapt the service of each community to its needs, to route traffic by the most direct lines, to develop terminals where most needed.

This kind of co-ordination, unification and development, while incompatible with competition in construction, is not incompatible with some competition in service. Mr. Mellen's theory is that the New Haven is a great terminal yard which all the railways that want to enter New England should be allowed to use with their trains. He would let the Grand Trunk and Canadian Pacific in from Canada on the same terms. He would let the railways of the United States in on the same terms. There would be no difficulty in carrying out this plan if Mr. Mellen's terms to the other railways should be reasonable; and the fact that the Grand Trunk shows willingness to accept them indicates that they are. The advantage of competition in service would be secured, while the disadvantage of economic waste by competitive construction would be avoided. This is not merely Mr. Mellen's plan. It is opposed by those who study and discuss the New England railroad situation as agitators, but endorsed by those who study and discuss it disinterestedly and with public spirit. One of these is Professor Bruce Wyman, of the Harvard Law school. Professor Wyman says in an article in the Boston *Transcript* of January 29: "Believing in unification of our railroads as I do, I am convinced that we can get better service from a single system than we could ever hope for from separate roads."

But whatever thoughtful men who devote their lives to the study of subjects such as this may believe, a large part of the public still believes that we should go on regulating railways, both by laws that aim to compel them to compete and by administrative bodies that make it hard or impossible for them to compete. The public still believes that it can perform the great equestrian feat of riding two horses running rapidly in opposite directions. Many public men still think so too. So long as the public and public men so think, doubtless we shall keep on our statute books utterly inconsistent laws for the regulation of the railroads. And so long as this is the case the grand juries will continue to grind out true bills indicting common sense.

THE LIMIT OF THE COMMISSION'S AUTHORITY.

THE decision of the Supreme Court of the United States in the Louisville & Nashville case (I. C. C. and U. S. vs. L. & N. R. R. Co.) destroys utterly the theory advanced by the Interstate Commerce Commission and its attorneys as to the authority of the commission. This theory was concisely stated by the commission in its annual report for 1911. The making of rates, it said, is a legislative function. "That being so, the discretionary power involved in reaching the conclusion that a particular rate is or is not reasonable for the future, or that a particular discrimination is or is not undue, is a legislative discretion which cannot be reviewed by the courts." Congress, it has been contended, has so completely delegated to the commission the legislative function of making rates that the courts can no more review and set aside one of its orders that is not confiscatory than they can set aside a non-confiscatory act of Congress. The commission, it has been maintained, may even base orders on information in its possession which has not been introduced at the hearing of the case before it, and of which the parties are not apprised.

Many lawyers, economists and public men have accepted this doctrine as having been established by the Supreme Court itself; and the Commerce Court has been severely criticized because it has reversed the commission in cases in which it has believed that the commission has not given a full hearing, or has ignored the evidence, or has made unreasonable orders. The Louisville & Nashville case is one of those in which the Commerce Court reversed the commission. The Supreme Court reverses the Commerce Court, disagreeing with its conclusion that the findings of the commission were not based on substantial evidence. But the Supreme Court completely upholds the principle laid down by the Commerce Court that the orders of the commission can be made only after a full hearing and must be based on substantial evidence and that the courts may inquire whether this has been done and reverse the commission if it has not been.

The law gives the right to a full hearing. "That," says the Supreme Court, "conferred the privilege of introducing testimony and at the same time imposed the duty of deciding in accordance with the facts proved. A finding without evidence is arbitrary and baseless. And if the government's contention is correct, it would mean that the commission had a power possessed by no other officer, administrative body, or tribunal under our government. It would mean that where rights depended upon facts, the commission could disregard all rules of evidence, and capriciously make findings by administrative fiat. Such authority, however beneficently exercised in one case, could be injuriously exerted in another; is inconsistent with rational justice, and comes under the Constitution's condemnation of all arbitrary exercise of power." "Under the statute," the court adds, "the carrier retains the primary right to make rates, but if, after hearing, they are shown to be unreasonable, the commission may set them aside and require the substitution of just for unjust charges. The commission's right to act depends upon the existence of this fact, and if there was no evidence to show that the rates were unreasonable, there was no jurisdiction to make the order. In a case like the present the courts will not review the commission's conclusions of fact by passing upon the credibility of witnesses, or conflicts in the testimony. But the legal effect of evidence is a question of law."

Commenting on the contention that the commission may use private information in its possession in deciding a case, the court says that "such a construction would nullify the right to a hearing, for manifestly there is no hearing when the party does not know what evidence is offered or considered and is not given an opportunity to test, explain, or refute." All the in-

formation on which the order is based must appear in the record of the case, "for otherwise, even though it appeared that the order was without evidence, the manifest deficiency could always be explained on the theory that the commission had before it extraneous, unknown, but presumptively sufficient information to support the finding. . . . The question is whether there was substantial evidence to support the order." If there was, the courts cannot settle conflicts in the testimony nor put their judgment above that of the rate-making body.

When the bill to abolish the Commerce Court was pending, Attorney-General Wickersham suggested that if Congress considered it expedient to make the commission's findings of fact binding on the courts, it might do so by enacting a specific provision to this effect. The decision in the Louisville & Nashville case indicates that this could not constitutionally be done. As has been shown, the Supreme Court says that the exercise of such authority as the commission has claimed "comes under the Constitution's condemnation of all arbitrary exercise of power," and that "the legal effect of evidence is a question of law." It follows that whether the commission has given legal effect to the evidence or has acted arbitrarily is a question which the courts have a constitutional power to pass on, even though confiscation is not involved.

Those who believe it would be expedient for the commission to be the final judge of the facts, with uncontrolled authority to regulate rates and service according to its good judgment, so long as its orders were not confiscatory, will be disappointed by this decision. They will say that the commission is more fit to deal with these matters than the courts and that judicial interference will hamper its work. But any administrative body, however expert and impartial, is apt to make mistakes which a court, though less expert, may detect and correct. The principle of court control of the commission is similar to the principle of commission control of the traffic managers. No one in his senses doubts that the traffic managers of the railways know more about how rates ought ordinarily to be made than the commission does. But the traffic managers have at times acted unwisely or unjustly, and so the commission has been authorized to correct their errors. So the commission knows more in detail about how rates ought to be made than any court. But the commission may at times act unwisely or unfairly. It is not merely a judge of the railways, but it is required to act as a detective to shadow them, and as a prosecutor to prosecute them. As long as it has these functions, and its members are human, it will not be entirely impartial. How then can it be reasonably contended that the courts should not be allowed to inquire whether the commission has acted in disregard of evidence, or without any evidence at all, or issued orders that are palpably unjust.

The main principle on which the government of the United States rests is that it should be a government of laws and not of men; that no one should have his life, or liberty, or property taken without the right to be fully apprised of the reason and to appeal to the courts to determine if the taking is just. The doctrine that the Interstate Commerce Commission should be given arbitrary power is simply the doctrine that the property rights of the owners of railways should not be given the same protection as the property rights of other persons. It is a doctrine that is inherently wrong and unjust, and it is gratifying that the Supreme Court has repudiated and condemned it. Perhaps it may be desirable that administrative officers should be given the arbitrary authority over *all* forms of property that it has been contended that the commission has over railway property. There are some people who believe that the bureaucratic autocracy is the best form of government. But until the people of this country are prepared to come to that it cannot be rationally, consistently or equitably contended that arbitrary power over railway or public utility property alone should be given to administrative officials.

Letters to the Editor.

SAFETY APPLIANCE INSPECTORS.

CHICAGO, January 27, 1913.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

Recently the equipment in the yards of a western railway was inspected by a government safety appliance inspector. The inspection occupied one hour, and was finished at 9 a. m. After it was completed the inspector was asked if he intended to inspect the equipment in the yards of another railway located in the same town, and about fifteen minutes' walk from the yards in which the inspection had just been made. He replied that the inspection of one yard was considered a day's work in government service, and that no inspector went over more than one yard in one day; he would, therefore, save the other yard for another day's work.

Government service is paid for by the public through the medium of taxation. The theory upon which government employees handle their work should be known, therefore, to all the public, and especially to the magazine muckrakers and all other reformers who are howling for government ownership of railways as the only means by which true economy and efficiency can finally be reached. Railroad men will not need more than one guess to decide how long a man who handled his work as outlined above would last in railroad service.

MASTER MECHANIC.

BASE FAILURES IN RAILS.

CHICAGO, Ill., October 29, 1912.

TO THE EDITOR OF THE RAILWAY AGE GAZETTE:

I have read with a great deal of interest the report of the accident on the Wabash near Lebanon, Ind., on March 7, 1912, made to the Interstate Commerce Commission by the chief inspector of safety appliances and accompanied by a report by James E. Howard of the Bureau of Standards. While this is an exceedingly valuable and painstaking report it has some statements which, I believe, are misleading to those who are not already well informed regarding rail investigations. The initial cause of failure was a broken base due to unusual or seamy metal. The seam itself is not shown, although a good deal of space is given to a description of the manner in which the rail was subsequently broken into several pieces as the locomotive wheels passed over it. It is to be regretted that micro-photographs of the seam itself are not shown so that the reader may form an idea as to just what kind of a seam is referred to. On page 5 the statement is made, "Statistics show that a large majority of the broken rails reported are defective in much the same manner as this rail." If this means that broken rails due to seams predominate, then the statement is correct, but if it means that seams in the base or base failures predominate then it is incorrect, as the tabulation of rail failures of the American Railway Engineering Association on page 349 of Bulletin 147 of that association shows.

No one will question the statement that a large majority of rail failures are due to unsound metal, but the statements made as to means being taken to correct the trouble are misleading. On page 17 the following is found:

> Herein is exhibited a structural defect which is prevalent, to a marked degree, in many rails. It is a defect the presence of which is well recognized and admitted. It has been the cause of occasional wrecks and a large number of renewals of rails. Notwithstanding these circumstances, rails are accepted under specifications and tests in which this, the most common cause for breakage, is not guarded against. Revisions of specifications have gone on, still omitting reference to this prolific cause of rail failures.

Surely Mr. Howard must be aware of the extensive researches which are being made at the present time both by the

railroads and by the manufacturers. The belief in well informed quarters at the present time seems to be that structural unsoundness is due to defects which originate in the ingot, and every feasible scheme to secure sound ingots will be tried as soon as its feasibility is demonstrated. There is a large variety of sizes and shapes of ingots all producing unsound metal at times, but no one has come forward with an ingot that will always turn out to be structurally sound. Mr. Howard also says:

> An overwhelming majority of rail failures is reported as due to base fractures, fractures which disclose the presence of streaks and seams in the steel. This seaminess of the metal can be revealed by crosswise bending of the flanges, and such a test for structural soundness is easily made. In fact such a method of examination has been employed in the past by the undersigned to show the prevalence of streaks in rails which had or had not displayed seamy fractures in the track. Tests governing the acceptance of a finished product should undoubtedly be directed to show the fitness of that product against its most common manner of failure in service.

The tabulation above referred to shows that an overwhelming majority of rail failures do not take place in the base. It must be admitted in fairness, however, that more failures are due to base failures than were formerly reported, but this may be due to the fact that at the present time everyone is on the lookout for that special item.

Base failures may be separated into two divisions: those with a rough fractured surface as though the metal had been torn apart, and those which show a smooth surface near the bottom of the base.

This smooth surface may be so narrow as to be hardly discernible, but is frequently a sixteenth of an inch wide. It is apparent that the causes cannot be the same in both instances, and much confusion has arisen in trying to assign reasons for these failures as though they were all of the same character.

Although our knowledge of the subject is far from complete, the following reasons have been assigned as causes of failures of the first type:

(1) Professor Fay believes that sulphide of manganese is the cause of the trouble. This produces structural unsoundness without apparent surface defects. When the rail is subjected to lateral strain the bottom of the base is in tension and as the sulphide of manganese is not able to withstand stress of this nature, the metal separates in a line parallel to the longitudinal axis.

(2) The T-rail now in use is not symmetrical with respect to either its horizontal or vertical axis. It is one of the peculiarities of steel that it does not spread much under pressure but elongates much more readily. In the process of rolling more pressure is apt to be placed on the base of the rail than on the web. The result of this is that the base will be elongated more than the web, thus setting up an internal stress at the junction of the web and base. With our present type of rail having a short radius at this point this stress is concentrated within a small area of the cross section.

(3) Another cause is cold straightening or "gagging" at the mills. It has been noticed that rails checked or made a snapping noise while being straightened in the presses, and the more recent specifications reject all such rails. It has always been difficult for me to see how this can happen in a rail otherwise sound. It would not appear to be probable that a vertical force would produce a vertical fracture in uniform material. Some inspectors also state that they do not hear this sound as frequently in open hearth as in Bessemer rails. However that may be, the sound is made by the release of some internal stress either by pulling apart a seam or breaking a thread of material which was weaker than that which surrounded it.

(4) Segregation, or the separation of the constituent elements of steel taking place in the ingot, reduces the transverse ductility, and if the separation is sufficiently marked, will make a plane of cleavage or separation when the portion affected is subjected to tensile or shearing stresses.

(5) Still another cause is lack of transverse ductility. It is a fact that when subjected to tensile stresses, rolled steel is stronger in the direction of its rolling than transversely. Just what difference should be expected is in some doubt at the present time as tests do not seem to have progressed far enough to be called a final demonstration. Also the transverse forces due to a moving train are not well established, as regards magnitude. Numerous investigations are being made along this line and our knowledge of the matter will be increased in time. From our present knowledge of the subject it appears to be a fact that a majority of the rails which fail from lateral pressure are structurally unsound. This unsoundness originates in the ingot and is generally local in character.

Under the second division we have: Seams due to pipe, inclusive of foreign matter, etc., and seams due to imperfect rolling conditions. Seams due to pipe may be almost any length up to the length of the rail or small seams scattered along at intervals. The seam cannot always be told when the rail is sawed unless it is discolored. The slag inclusions, etc., are discolored and are readily told if the rail is cut at the point, but may be found anywhere in small pockets. Seams due to rolling conditions, if on the surface, are easily seen and seldom are found in the tracks, as the rail is rejected at the mill.

Another reason for seams in the base has been brought forward by some writers. They claim that the skin which is first formed on the bloom in rolling becomes wrinkled, and as the section is reduced this skin is rolled into the rail base. This occurs after the rail has cooled below the point when welding will take place. This defect in mill practice seems to be well founded and will undoubtedly be eliminated as time progresses.

The present drop tests with the addition of the latest ductility tests and chemical requirements are intended to eliminate general defects in the manufacture of rail and are fairly successful in that respect. These specifications are progressive in character and changes will be made from time to time as particular points or betterments are demonstrated. But with regard to the defects described above which are local in character, the situation is different. Tests of sample pieces do not show the trouble. In order to eliminate this kind of trouble each rail must be tested separately in such a manner as to reveal it. Mr. Howard says he has such a test. Will it be practicable for him to test 4,000 rails a day, the output of the Gary mill, by the method he refers to?

I believe the study of rail steel and concurrent troubles arising from the use thereof is only in its infancy. The man who will know all about it is not yet born. In the meantime, general statements unaccompanied by a large number of qualifying adjectives are apt to mislead those who have no exact knowledge of the subject matter under discussion. However it must be borne in mind that specifications and tests of the kind now in use and those along the same general lines will largely eliminate the local defects as found in this particular instance when a critical inspection is made at the mills.

Paul M. La Bach,
Assistant Engineer, Chicago, Rock Island & Pacific.

Clearances in Australia.—For more than seven years the railway departments of the several states have agreed to a standard uniform clearance in connection with bridges and tunnels on both the 4 ft. 8½ in. and 5 ft. 3 in. gages. As the Commonwealth government has finally decided on the 4 ft. 8½ in. gage for the Transcontinental line, together with the possibility of 4 ft. 8½ in. being adopted as the standard gage throughout Australia, the question of the minimum clearance has been considered by a special conference of the railway commissioners of the several states and Tasmania. The new scale of clearances—the size of the locomotive being the governing factor—which have been agreed on provides for an increase from 14 ft. 6 in. to 15 ft. in the vertical height clearance from the center of the track, whilst an additional space of 6 in. has been allowed for on each side of the line as far as the width of the bridges and the distance of platforms from the center of the track are concerned.

TRANSPORTATION OF FRUIT AND VEGETABLES.*

A Fast, Difficult, Expensive Service Rendered at Relatively Low Rates—Need for Co-operation Between Shipper and Carrier.

By E. D. Levy,
Assistant General Manager, St. Louis & San Francisco.

There are various kinds of refrigerator cars used for the transportation of fruits and vegetables, but when each of the various styles of cars is analyzed carefully it will be found they are all based on practically the same principle, i. e., an insulated box car, with insulated side doors and hatch plugs, containing ice bunkers. Briefly, the efficiency of the refrigerator, or the preservative features, is determined by the number of layers of insulation, its quality and thickness, and the character of workmanship in the construction of the car, side doors and hatch plugs. It is an old adage that a chain is only as strong as its weakest link. This applies to a refrigerator car because if the car is not uniformly air proof it will not protect perishable freight from heat or cold. It would be the height of folly to build an expensive refrigerator car, properly constructed and insulated, and apply ordinary box car doors. For that reason I think cars known as insulated box cars, having no ice tanks, which are insulated at the bottom, sides, top and ends, and are equipped with end and side doors similar in construction to those that are applied on common ordinary box cars, are no better for preserving freight or protecting freight from heat or cold than the ordinary box cars. The use of these so-called insulated box cars should be discouraged in the territories where the temperature falls below 32 deg. or the freezing point.

Refrigerator cars are the most expensive cars used by railroads in the transportation of freight. It costs more to build them and more to maintain them. The average weight of a modern 60,000 lb. capacity refrigerator is 46,000 lbs., or 23 tons. The average weight of a modern 60,000 lb. capacity box car is 34,000 lbs., or 17 tons. When perishable shipments are moved under ice, the average weight of the ice is about 8,000 lbs., or four tons, making the weight of the empty car and the ice 27 tons, as compared with 17 tons for a 60,000 lb. capacity box car. The average weight of fruit or vegetables in car lots is about 12 tons. The average weight of a carload of revenue freight on the road I represent, including perishable and all other carload shipments, is 26 tons. It follows, of course, to make the average of 26 tons, a great many commodities will run 40 or more tons and some as low as 10 or 12 tons. I mention these facts in order that you may understand that with a car of perishable freight, containing about 12 tons on which we collect revenue, we transport free of charge when under ice a dead weight of 27 tons, and when not under ice a dead weight of 23 tons, as compared with other carload commodities where the weight of the freight in most cases exceeds the weight of the car. To make an intelligent comparison, I will say that, with a car of fruit or vegetables under ice, we have approximately 12 tons of freight, and the dead weight of the car and ice is 27 tons, or 2¼ times the weight of the commodity transported and on which the carriers collect freight charges. With the average car of freight containing 26 tons of revenue freight, the modern 40 ft. box or coal car will weigh 20 tons, or only 77 per cent. of the weight of the commodity transported.

Another feature that is very important and must not be lost sight of is that usually the refrigerator car must be moved empty from the point where it is made empty to the point where it is again required for the loading of perishable freight.

PROPER TRANSPORTATION.

For a number of years I have been connected with a railroad that handles a large amount of perishable freight of every character, and I have come to the conclusion that proper and reasonable service, that would be fair alike to shippers and consignees and to the carriers, is an average speed of 12½ miles an hour for less-than-trainload lots from origin to destination or junction point, and an average speed of 15 miles per hour for trainload lots of ten or more cars. The less-than-trainload lots should be moved on regular through freight trains scheduled at an average speed of approximately 12½ miles an hour from point of origin to destination or to the junction point with another line. There would, of course, be some delay at the junction point which would amount to about four hours at each junction point where the cars were delivered to a connecting carrier. The 12½ and 15 miles an hour schedule sounds slow for perishable freight. But if anyone will take the time to consider the average conditions under which fruit and vegetables in car lots are transported from producing territories to consuming centers, and give due consideration to the difficulties of transportation—the fact that usually in the producing territories the commodities must be gathered up from a number of stations and taken to a nearby point and re-iced, and must be re-iced not less than once every 24 hours; that division terminals where engines and crews are changed are located at about every 125 miles of the journey; that freight trains are subject to delays of various kind, including those caused by the elements, must take water and coal, must meet and pass passenger trains and other freight trains, and that there are other unavoidable delays too numerous to mention—he will agree that a speed of 12½ to 15 miles an hour maintained from point of origin to destination or to junction point with connecting carrier is an exceedingly good performance. An average of 12½ or 15 miles an hour each 24 hours will cover considerable distance.

DIFFICULTY OF MAKING FAST TIME.

When one stops to analyze he will find that it means very fast running for a freight train to maintain this average, and for the purpose of illustrating I will use a trip from New Orleans to Denver, using the Illinois Central to Memphis, the Frisco Lines from Memphis to Kansas City and the Rock Island Lines from Kansas City to Denver. We will first deal with the less-than-train lots which are handled on regular trains. Freight trains cannot be gotten through an average district terminal in less than one hour to one hour and thirty minutes, and more often it consumes one hour and thirty minutes than it does one hour. On the Illinois Central there are two district terminals between New Orleans and Memphis where engines and crews must be changed and loads switched in and out of the train. One hour and thirty minutes for each district terminal means three hours dead time. On the Frisco there are three district terminals between Memphis and Kansas City, one hour and thirty minutes at each of which makes four hours and thirty minutes dead time. On the Rock Island, between Kansas City and Denver, there are five district terminals, and one hour and thirty minutes at each means seven hours and thirty minutes dead time. Consequently, on this journey of 1,515 miles, New Orleans to Denver, there would be ten district terminals where crews and engines are changed and the train inspected and switched. The 15 hours should be deducted from the 121 hours, leaving 106 hours for running, which, divided into the distance of 1,515 miles, makes an average speed of 14.3 miles per hour. On the basis of 14.3 miles per hour as an average speed between district terminals the train would cover a 100-mile division in seven hours.

Now, take a train lot of ten cars or more at an average speed of 15 miles an hour, and at each district terminal allow one hour for changing engines and crews, inspecting train and nec-

*Abstract of an address delivered before the Western Fruit Jobbers' Association at New Orleans, La., on January 16, 1913.

essary switching, which would make a delay of 10 hours to be deducted from the running time of 101 hours, leaving 91 hours running time, which would make an average speed of 16.6 miles per hour, and at this rate of speed the train would cover 100 miles in approximately six hours.

This average speed of 14.3 and 16.6 miles per hour is the average speed at which the train must move between district terminals, and does not take into consideration any delay for taking water and coal, meeting and passing passenger trains and other freight trains, and the countless other delays that a freight train must encounter on a single-track railroad. It is an actual fact that a perishable freight train on a busy single-track railroad does not cover a 100-mile district without encountering an average of two hours' delay. This would reduce the actual running time over each 100-mile district to five and four hours, respectively. At five hours it would mean an average speed of 20 miles an hour; at four hours an average speed of 25 miles an hour. In order to maintain this average speed of 20 or 25 miles per hour, the train must make a maximum speed of 35 to 45 miles per hour while moving. I do not mean to say that at all times when the train is in motion it will make 35 to 45 miles per hour, but I do say that to make an average speed of 20 and 25 miles an hour a train must, to offset the delays in slowing down for various reasons, run at times 35 to 45 miles an hour. When I say times I mean many times. I have known instances where freight trains ran 50 to 60 miles an hour. Anything over 40 miles an hour is very fast time for a freight train. If you have any doubt about 40 miles per hour being fast for a freight train, you would soon be convinced if you rode one at that speed over an average railroad.

THE REVENUE RECEIVED RELATIVELY LOW.

I maintain that it is to the advantage of the fruit trade as a whole that it shall not urge railroad companies to make excessively fast schedules, but urge all railroads to adopt uniform schedules so that when connected up they will provide reasonable schedules from the point of origin to the point of destination. On a reasonable schedule railroads can handle the perishable freight with some degree of profit. This they cannot do when they handle it at an excessively fast speed. We have moved many a trainload of perishable freight over the railroad at an average speed of 20 miles an hour, including all delays. I am not saying this because I am proud of it. When a freight train moves at an average speed of 20 miles an hour, including all delays, the commodity transported must pay very high rates to make it profitable to the railroads.

It is an old saying that a railroad is a merchant, the raw material it buys is freight train miles, and the manufactured product it sells is ton miles of revenue freight.

We do not figure the cost of moving a single ton one mile, but, for convenience, figure the cost of moving 100 revenue tons one mile. Assuming for the sake of easy illustration that it costs an average of $2 to move a freight train one mile, it would mean each 100 revenue ton miles would cost one-tenth of $2 or 20 cents. If the train handled but 500 revenue tons 100 miles, it would produce 50,000 net revenue ton miles, and the cost would be 40 cents per 100 revenue ton miles. If the train handled 250 revenue tons 100 miles, it would produce 25,000 revenue ton miles and the cost would be 80 cents per 100 revenue ton miles.

These illustrations are given to make it very clear that the more tons of revenue freight are hauled in a train at the same expense the cheaper the cost of hauling one ton. Fast speed with a freight train can only be made by reducing the number of tons in the train. The cost of labor and materials of all kinds, and in fact every item of cost that enters into producing revenue ton miles, has increased and is increasing. Railroads must, to meet this increased cost, sell their revenue ton miles at a higher rate or produce them at a lower cost. It is a hard matter to raise rates and it is equally hard to reduce costs. A railroad must be operated economically the same as you must conduct your business economically. As an illustration of how the decreased purchasing power of a dollar in wages has prevented our increased loading of trains from reducing our cost of producing a revenue ton mile I will say that in the year 1912 our increased loading per train mile was 69 per cent., as compared with the year 1900; and the revenue ton miles produced per dollar of wages paid employees decreased 16.3 per cent. In other words, please remember that, notwithstanding an increased loading of 69 per cent., our cost per ton was actually increased 16.3 per cent. by reason of increased wages we were forced to pay. For fear this fact may not be clearly understood, I will add that the increase in trainload indicates increased efficiency in operation, which, great as it has been, has failed to overcome the effect of increased wage scales. The economical rating of a locomotive is to give it the tonnage it can move over the railroad at an average speed of approximately 10 miles per hour from terminal point to terminal point. To make a higher rate of speed than this there must be a reduction of tonnage.

A train of fruit or vegetables weighing an average of 12 tons of revenue freight per car would have to consist of 25 cars to produce 30,000 revenue ton miles over a 100-mile district; of 50 cars to produce 60,000 revenue ton miles over a 100-mile district; and of 100 cars to produce 120,000 revenue ton miles over a 100-mile district. Twenty-five cars of perishable freight, amounting to 300 revenue tons, is a big average trainload; in fact, the average revenue trainload of the railroad I represent at the present time is about 340 net tons. The gross tons in an average train, other than perishable freight trains, are about double the revenue tons. With a train of fruit or vegetables under ice, the tare weight of cars and ice in a train of 25 cars, which produces 300 revenue ton miles, would be 2¼ times the revenue tons, or approximately 700 gross tons. In other words, with a train of ordinary freight weighing 700 tons gross, we would collect freight on approximately 350 tons. With a train of fruit and vegetables, on which we would collect freight on 300 tons, we would have to haul approximately 1,000 tons gross.

I am not going to mention the liability from a loss and damage standpoint, because if a railroad will first decide upon a reasonable schedule and then maintain that schedule, and furnish proper refrigerator cars, there should be no claims. Where claims on a carload fruit and vegetable movement are excessive it is due, I believe, to the fact that the railroad has not provided the proper equipment and has provided a fast schedule it cannot maintain, or there is a lack of organization in the originating territory. The transportation of fruit and vegetables in carloads is only profitable when the commodities can be transported at a reasonable speed. As the rate of speed is increased, unless the rate of revenue increases proportionately, the freight becomes unprofitable. This is a general statement which, in the majority of cases, will be found true.

To remove the illusion the fruit men are under when they think fruit and vegetables are entitled to excessively fast schedules by reason of relatively higher rates, I give below a table of ten common commodities of the railroad I represent, showing the weight of the revenue freight, the weight of the car and the total weight; the average earnings per ton per mile of revenue freight, and the average earnings per ton of gross weight for the fiscal year ending June 30, 1912. It is fundamental that it costs as much to haul a ton of car as it does a ton of fruit or any other commodity. This being true, the average earnings per ton of gross weight transported must be considered and not the average earnings per ton of revenue freight.

Commodity.	Net Tonnage	Tare	Gross Tonnage	Average earnings per rev. ton mile (in cents)	Average earnings per gross ton mile (in cents)
Live stock	11	17.6	28.6	1.491	0.573
Soft coal	40	18.5	58.5	0.603	0.412
Flour	17	17.6	34.6	0.834	0.410
Corn	28	17.6	45.6	0.635	0.390
Lumber	24	17.6	41.6	0.673	0.388
Cement, brick and lime	25	17.6	42.6	0.634	0.372
Fruit and vegetables, not iced	12	23.0	35.0	1.079	0.370
Iron (P. & B.)	34	17.6	51.6	0.557	0.367
Fruit and vegetables	12	27.0	39.0	1.079	0,332
Oats	22	17.6	39.6	0.536	0.298

These figures prove conclusively that we earn less per gross ton per mile on fruits and vegetables than we do on corn, flour, coal, iron, cement, brick and lime and lumber, and the fruit and vegetables must be moved at fast speed at greater expense.

I mention these facts to drive home the argument that the carriers must either be permitted to transport the fruits and vegetables at a reasonable rate of speed, which enables them to protect their expenses, or, on the other hand, be compensated with a commensurate increased rate of freight.

DISTRIBUTION OF LESS-THAN-CAR LOTS.

It is only recently that railroads in the Middle West have inaugurated refrigerator car service to protect less-than-carload shipments of fruit and vegetables from heat and cold. The railroad I represent does not run any scheduled refrigerator cars from jobbing centers to protect less-than-carload shipments of fruit and vegetables from heat, but does run, from November to March, inclusive, scheduled refrigerator cars from the large jobbing centers on certain days of each week to protect less-than-carload shipments of fruit and vegetables and other perishable freight from damage by frost. I believe the carriers should provide this service from jobbing centers wherever there is a demand for it.. It is much easier to provide scheduled refrigerator car service as protection against frost in the winter months than it is to provide similar service against heat in the summer months, because in the winter months if there is not sufficient tonnage of perishable freight to justify a scheduled car other miscellaneous freight can be loaded in the same car without damage to the ordinary merchandise or the perishable freight. In the summer months when the car is under ice, and is damp, there is more or less risk in loading in a refrigerator car, certain commodities being subject to damage from dampness.

It is more expensive to the carrier to run scheduled refrigerator cars for the distribution of less-than-carload perishable freight either in the summer or winter months, compared with the ordinary box car, because merchandise is a light commodity and you cannot load sufficient quantities of the freight in the car to give a capacity load. The cubic space available for loading in a refrigerator car is much less than in a box car. The refrigerator car weighs from three to six tons more than the box car, and there is the expense of icing it in the summer months and heating it in the winter months. Consequently, this scheduled refrigerator service from jobbing centers should be limited to the actual requirements and a scheduled car should not be run each day unless there is a sufficient volume of perishable freight moving to justify it. In most cases a scheduled refrigerator car moving from the jobbing centers two or three times a week will answer all requirements.

There does not seem to be any necessity for iced refrigerator cars for the distribution of perishable freight in the summer months as a protection against heat, because there does not seem to be any great demand for them. There must be considerable necessity for refrigerator car service in the winter months as a protection against frost because there is a great demand for it.

It is to the interest of the carriers, as well as the jobbers, that the railroads provide equipment and service that will enable the perishable freight to be shipped from points where it is produced to the distributing centers and from the distributing centers to the points of consumption in all kinds of weather. When, in the absence of proper scheduled refrigerator car service from the jobbing centers, the weather becomes so cold that the jobbers cannot ship and they purchase a smaller quantity, the growers lose the sale on account of the decreased demand and some of their products perish if not sold when ready for market and are a total loss. The railroads lose the revenue on the haul of carloads to the distributing centers and lose the revenue on less-than-carload shipments from the jobbing centers to the local points of consumption.

The railroad I represent had a very costly experience the past two years in attempting to provide scheduled refrigerator cars from the jobbing centers for the protection of less-than-carloads of perishable freight against frost. A large amount of perishable freight reached destination frozen. As a result of that experience, we have provided oil stoves to be placed in each scheduled frost-proof car, to remain in the car all day from the time loading is started until just a short time before the car is pulled from the merchandise platform. We have provided canvas curtains to be fastened on each side door, opening in the middle like the flap of a tent, which affords protection while the car is being loaded. During the two previous years, we did not provide the stoves and tarpaulins in the cars and considerable of the freight was no doubt damaged during the process of loading. There was some freight damaged during the time it was being transported from the jobbers' houses to the station. We now require the freight to be delivered at the station early in the afternoon, closing the frost-proof scheduled cars an hour or two before the ordinary merchandise cars are closed, so the cars may remain with the doors closed for an hour or two with the lighted stove until the temperature is raised to a reasonable point. We do not move any loaded cars with lighted stoves in them, and immediately before the cars are sealed the doors are opened and the stoves removed. We prohibit train crews, in distributing the freight, from leaving the doors open for the purpose of furnishing light. They must use a lighted hand lamp, enter the car, close the door behind them, move all the freight for that particular station to the doorway, open the door and unload the freight as quickly as they can and close the door. In very severe weather when the temperature of the car is in danger of reaching a point that will frost the contents, we set the car out and have the agent protect it with a stove.

NEED OF CO-OPERATION BETWEEN SHIPPERS AND CARRIERS.

It is of such vital interest to the carriers and the jobbers, to say nothing of the producer and consumer, that opportunity be afforded for the free distribution of perishable freight practically each day in the year, that it behooves both the carriers and the fruit jobbers to approach this subject as all similar subjects should be approached, i. e., in a spirit of mutual co-operation, and to build up an organization that will enable both to conduct their businesses every day in the year at a fair profit. The first step in this direction should, in my opinion, be a local organization of the fruit jobbers at each jobbing center, whether it be a local branch of the Western Fruit Jobbers of America or a local organization of the fruit jobbers independent of this or any other association. This association should then appoint a transportation committee, and this committee should work out with the carriers the problems of distribution of the perishable freight. It is very unsatisfactory now to handle with the various individuals the question of scheduled cars—you can secure as many opinions as you consult men. This transportation committee should study the distribution problems from all angles, meet with the railroads and work out a system of schedules, for both winter and summer, to meet the demands of the fruit jobbers and not to be an undue tax upon the carriers. I am quite sure all of the carriers would be willing to co-operate with the transportation committee of the fruit jobbers, and where the carriers did not show a proper spirit of co-operation the fruit jobbers could, acting as a unit, convince the railroad that it was to its interest to do so or perhaps incur the loss of other business. In other words, to be plain, roads that do not give proper service for the distribution of less-than-carload perishable freight should not be favored with the routing on the carloads into the distributing centers.

Carriers do not always use the proper means for protecting perishable freight and shippers do not always use sufficient care in protecting their shipments from their place of business to the railroad station. I am not undertaking to say that the fault is all with the shippers, nor am I willing to admit it is all with the carriers. We are both lax, and what we should do is co-operate along intelligent lines to improve the methods of both and bring the distribution of less than carload perishable freight from the uncertain state which it is in to a state of high perfection where its transportation will be as regular as the United States mails, even if not as fast, and its protection from the

jobbing houses to the stores of the consumers absolutely insured.

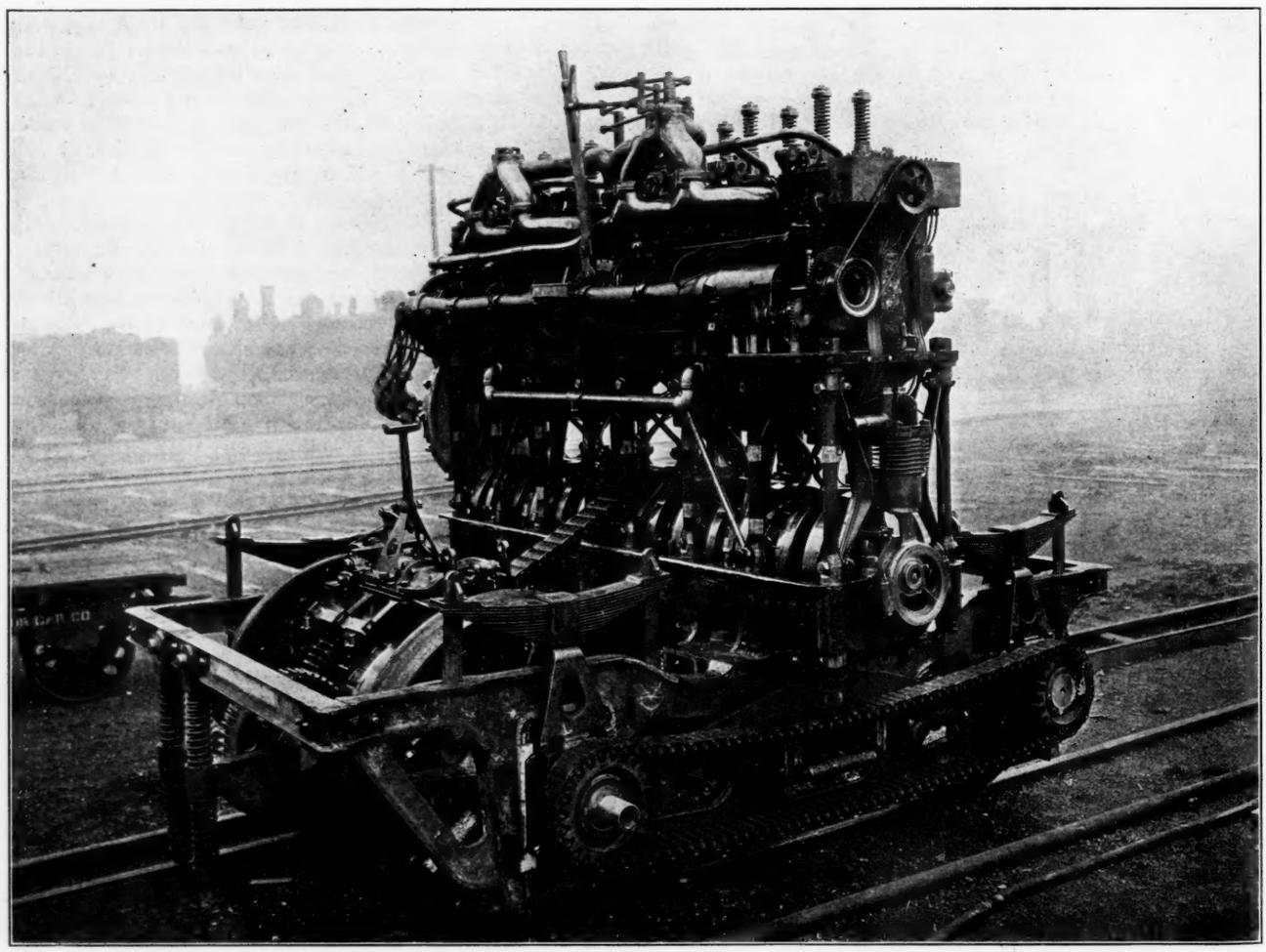
I believe that the perishable freight for the scheduled refrigerator cars should be delivered at the freight stations within a space of two hours, whichever two hours might be decided upon to be the best for all concerned, and in this way the car door would be open but a short time for loading freight, as compared with the present practice. In the winter months, the two hours that are usually the warmest should be selected and in the summer months the two hours that are usually the coolest. There is just as much liability that perishable freight will be damaged by frost in extreme temperatures in being moved from the houses of the jobbers to the freight station as after receipt at the freight station. Consequently, the jobbers should give the freight proper protection while in transit to the station, and the hours in which it is decided to deliver this perishable freight to the station should be hours that are not classed as rush hours, so the highly perishable commodity will not be held on the wagons awaiting its turn to reach the platform and after reaching the platform be held there awaiting to be handled into the cars. The wagons should be immediately received at the platform, another freight immediately unloaded and placed in the scheduled cars. It is not satisfactory to the fruit jobbers to have the freight reach destination in an unsalable condition, even though they are able to collect damages for the loss from the railroad. What the fruit jobbing interests want, and must have, is dependable service that will place these highly perishable commodities in the houses of the country merchants, if you please, in the same condition in which they left the jobbing houses, and I maintain it is possible to do this, and that it is only possible to do it by the carriers and the fruit jobbing interests working in a spirit of intelligent co-operation.

NARROW GAGE GASOLENE MOTOR CAR.

Five 30-ton, all-steel gasolene motor cars have recently been built for the Queensland government railways, Australia, by the McKeen Motor Car Company, Omaha, Neb. They have a gage of 3 ft. 6 in., and are 62 ft. 5¼ in. long over the bumpers. While in general they conform to the standard design and construction of the McKeen cars, there are some special features of interest. They are to be operated from the left side, have the side type of buffing gear and are provided with draw hooks and screw couplings in place of M. C. B. couplers. The entrance to the car is in the center and is so arranged that the passengers may board it from the ground, as well as from elevated platforms, a trap door being used as on Pullman equipment. Each car has a total seating capacity for 69 passengers, 55 in the main compartment and 14 in the smoker. The car bodies are 59 ft. over end sills and 8 ft. 9 in. wide over the sheathing. The height from the rail to the roof is 11 ft. 8½ in., and from the floor to the ceiling, 7 ft. 8⅛ in. The distance between the center plates is 34 ft. and the total wheel base is 40 ft.

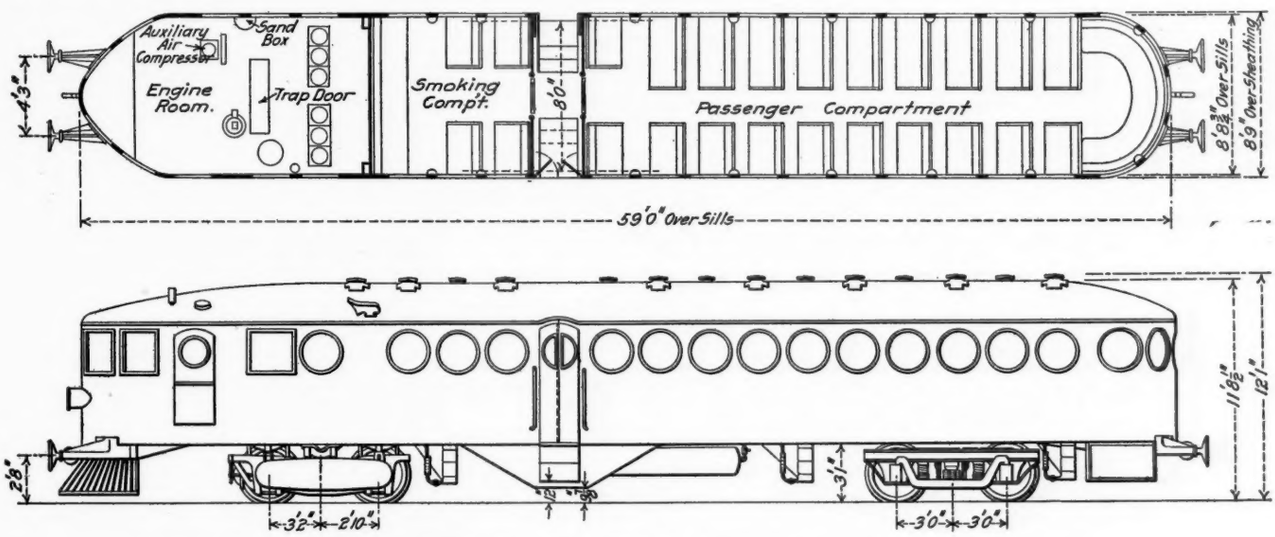
The engine consists of six 10 in. x 12 in. cylinders with a rated capacity of 200 h. p. It is started by compressed air and is reversible. The car has two speeds, direct and geared, and is operated by a multiple disc clutch. A Morse silent chain drive transmits the power from the engine to the forward axle, and from axle to axle, as shown in the illustration.

The motor truck wheel base is limited to 6 ft., which, with a specially designed front bolster, allows the cars to operate on the sharpest curves of city railways. The motor truck side frame is of cast steel, being made in one piece, and is bolted and wedged against the bed plate. The truck is unusually light and



Six Cylinder Engine of 200 H. P. Capacity for McKeen Narrow Gage Motor Car.

strong, and has four 36 in. steel tired wheels on 6 in. x 10 in. axles. The wheel centers are of cast steel. The weight on the front drivers of the forward truck is 17,900 lbs., on the rear drivers, 17,500 lbs., and on the rear truck is 24,600 lbs. These are the first narrow gage motor cars turned out by the McKeen Company, and will be shipped to Australia in a knocked down condition. The Stone electric system of lighting is used.



Narrow Gage McKeen Motor Car for the Queensland Government Railways.

RESULTS OF PUBLIC OWNERSHIP IN FRANCE.*

BY YVES GUYOT,
Former Minister of Public Works, France.

I will speak here only of the latest results of the nationalization of railways in France, according to the reports submitted to the Chamber of Deputies for supplementary credits on the 1912 budget and to establish the 1913 railway budget.

The advocates of the acquisition cannot deny the progressive increase of State railroad expenditures, but, in order to attenuate the expenses of the State Western railway, they indicate as their starting point the figures of the Western company in 1908. Now the acquisition was voted by the Chamber of Deputies in December, 1906. The company had no longer any authority over its staff; its position was entirely abnormal. Moreover, it had during the year 1908 to bear expenses which, but for the acquisition, would have been nominally carried over to the 1909 accounts.

These unsatisfactory conditions of the Western company give yet stronger relief to the gravity of the increase in expenditure of the acquired railroad:

	1908. Francs.	1912. Francs.	Difference. Francs.
Gross receipts	217,645,100	244,335,000	+26,689,900
Working expenses	147,958,700	220,262,900	+72,304,200
Net revenue	69,686,400	24,072,900	—45,614,308
Capital expended	101,509,100	106,347,000	+ 4,837,900
Deficit	31,822,700	82,274,900	+50,452,200

And again it must be remembered that the real deficit for 1908 was only 28,522,675f. 68c., to which the general reporter for the budget, M. Chéron, adds 3,300,000f., an increase of expenditure resulting from the agreement which determined the acquisition annuity.

As regards the former state railroad, it can only be a question of the receipts and expenditure of its working, as the capital for the establishment of the system has not yet been determined. Since 1908 the net products of the working of this line have considerably diminished.

The receipts have therefore risen by $8,000,000, whereas the expenditure progressed by $15,000,000. Here we would make the same remark as for the Western railway.

	1908. Francs.	1912 Francs.	Difference. Francs.
Gross receipts	58,969,411	67,150,000	+ 8,180,588
Working expenses	47,583,176	63,009,900	+15,426,723
Net revenue	11,386,235	4,140,100	— 7,246,135

Mr. Chéron, having observed the annual increase of receipts to be 3 francs 50 centimes per 100 [3½ per cent.], which he considers "simply satisfactory," remarks:

"It is therefore solely on account of the very important progression of expenditure that the net product of working has fallen."

The government forecast for 1913 was:

	Francs.
RECEIPTS.	
State Western Railway	460,208,000
Old State Railway	111,911,000
	572,119,000
EXPENSES.	
State Western Railway	530,079,000
Old State Railway	108,101,000
	658,180,000

—or an excess of expenditure of 86,000,000 francs.

The Budget Commission has made every possible effort to attenuate that deficit in the working. It has brought back the evaluations of receipts to 562,000,000, that of the expenditure to 642,000,000; and thus the forecast as regards receipt insufficiency is not greater than 80,000,000 instead of 86,000,000. Judging by experience, it is probable that at the end of 1913 the second figure will be greatly exceeded.

The reporters, Messrs. Chéron and Perrissoud, anxiously ask themselves: "What is the cause of this increase in receipts and decrease in net revenue?"

The answer is plain—expenditure increases more rapidly than receipts.

When the state purchased the Western railway, it was well known that it was unable to maintain order and efficiency in the navy arsenals. Nevertheless, it did not hesitate to add to the 10,000 employees which it already employed on the old line 50,000 other employees. It was easy to foresee that the strike would certainly occur, and it did occur in 1911.

The government reinstated all the strikers; it instituted delegates' councils, who naturally, before thinking about consignees and travelers, think of the interests of their mandataries and of their own.

Deputies, ministers, and, in consequence, directors, engineers,

*From the Annual Financial Review of the New York *Times*, January 5, 1913.

controllers, station masters, and foremen of workshops all tremble before the workmen and the agents whom they are expected to supervise and to direct in their work. The increase in expenditure for the employees which has occurred since Jan. 1, 1909, is:

	Francs.
For the old line	12,171,000
For the Western line	58,306,000
Total	70,477,000

In the working expenditure, this is how the expenses have been apportioned for employees and stock, in 1904, 1908, and 1912, and forecast for 1913:

	For labor. Francs.	Other expenses. Francs.	Total. Francs.
OLD LINE.			
1904	20,554,000	17,232,000	37,786,000
1908	24,337,000	23,246,000	47,583,000
1912	35,655,000	27,354,000	63,009,000
1913	36,508,000	26,823,000	63,331,000
WESTERN LINE.			
1904	65,362,000	42,388,000	107,750,000
1908	79,076,000	68,917,000	147,993,000
1912	133,168,000	89,239,000	222,402,000
1913	137,382,000	88,355,000	225,737,000

On the old line the expenditure for labor increased by 4,000,000 for the period 1904-1908, and by 16,000,000 for the period 1904-1913; whereas the other expenses vary only in the proportions of 6,000,000 from 1904-1908 and 9,500,000 from 1904-1913. The proportion therefore reverses from 1908, at which date the line was increased, owing to the acquisition.

For the Western line the labor expenditure increased by 14,000,000 from 1904 to 1908, and the other expenses by 26,500,000. The line was run by the state in 1908. From that date until 1913 the staff expenditure increases by $58,000,000 and the other expenses only increase by 20,000,000. Consequently the working of the line is subordinated to the convenience of the employees. It is run only for the benefit of the employees, rather than for the shippers or for the travelers.

From 1907 to 1913 the receipts rose on the old line by 13,000,000, and the expenses of employees by 14,000,000; for the acquired Western line the receipts increased by 47,000,000, and the labor expenses by $63,000,000, i. e., a decrease in receipts of $1,000,000 for the old line and of $16,000,000 for the Western.

The efficiency of the labor is not in proportion to the increase in advantages in its favor; but illness frees an ever increasing number of men to rest, thus, in the offices and terminals:

	1909.	1910.	1911.
Number of employees	3,852	4,844	4,515
Number on sick leave	1,291	1,582	2,044
Per cent. on sick leave	34	36	45

Similar figures for the employees in the transportation and maintenance departments show as follows:

Men employed	56,743	58,800	63,452
On sick leave	25,924	27,974	34,772
Per cent. on sick leave	45	48	55

Thus, more than one-half of the employees of the state railroads suffered from ill-health. The explanation is very clear. In case of sickness, the men receive full pay. Laborophobia is an irresistible illness for a certain category of railway men. It is a contagious disease, the more so in that it appears to afford nothing but advantages.

This increase in expenditure and restriction of labor yielded the following result: The average receipts on the state line, per employee, is 4,000 francs, whereas on the other French lines it is 5,100 to 6,200 francs.

It is hardly probable that any effectual remedy will be invented for this state of affairs; for the budget reporters, instead of looking to the management to cure the situation, place all their trust in the men, who have, during the past years, manifested such strong prejudice in favor of higher wages and less work.

Commercial undertakings managed by the state constantly evade parliamentary control. The financial law of July 13, 1911, ruled that a financial controller should be appointed for state railroads.

But the management protested against such a measure, and the Budget Commission reporter appealed at one and the same time "for careful control of accounts, and liberty for the railroads to break away from hampering tutelage."

And, indeed, the railroad boards have already made good use of such freedom "without waiting for the appearance of a decree, they have made numerous purchases of land, and started a somewhat considerable number of undertakings." A portion of the 300,000,000 bonds which were issued was devoted to the payment of land purchases, and work commenced before any decree appeared or any credit had been voted.

The board of management of state railroads is busy with extensive projects. Instead of confining such plans within the limits of the means at their disposal, they rely on the power of the state to issue bonds. On March 12, 600,000 4 per cent. 500 franc bonds were issued. They were issued at 503 francs and the price realized by the state was 495. There had been some intention to issue a new lot of 200,000 bonds, but in the face of this result of the first issue it seemed too risky to make such an attempt.

Issuing the 4 per cent. bonds at par was equivalent to marking the 3 per cent. rente down to 75 francs, except that the state bonds (rente), being free from tax, to which, on the contrary, the railroad bonds are subject, and the said tax amounting to 12.50 per cent., the rate of the parity was in reality lowered to 87.50. It fell actually to 90 and the minister is doing all he can to raise it again; he makes use of every means of persuasion and pressure to induce the credit houses and bankers to purchase, although it was he himself who lowered the rate.

The results of the state purchase of railroads may be summed up as follows:

The working of state railroads is more costly for France than had even been foreseen by its adversaries. It has proved the powerlessness of Parliament to control such undertakings. It has set up a class of workmen and employees who consider that the line is run for their benefit and not for the convenience of shippers or travelers. It has dealt a hard blow to public credit in France.

BULGARIAN RAILWAYS.—Since 1878, when it first became independent, railway construction has steadily gone forward in Bulgaria. In the year mentioned only two lines were in existence, from Routschouk to Varna, built by Turkey for strategic purposes, and from Armanli to Bellovo, which links up Constantinople with western Europe. By the Treaty of Berlin, Bulgaria took up the financial obligations entered into by Turkey towards the company which had been granted the concession for the first line, which was subsequently taken over by the government. As the result of conferences with Austria-Hungary, Turkey and Servia, a detailed scheme was drawn up for the construction on Bulgarian territory of railways which should form useful links for international traffic, with the result that by 1889 the country was traversed by a line forming part of the important international route between Paris and Constantinople. In the same year there was also begun the construction of the line from Sofia, the capital, to the port of Varna. This line, passing through Tirnovo, is the most important so far as domestic traffic is concerned. On the completion of links now under construction or projected, the capital will also obtain direct communication, by means of a second line, with the port of Burgas, which is already connected with Constantinople, via Adrianople. All the Bulgarian railways are single track, which has hitherto sufficed for the needs of the traffic, and they are also not designed for high speed running. The whole system is operated by the government, and its length is at present about 750 miles, which will be increased to about 1,080 miles when the lines now under construction are finished. The aggregate capital expenditure will then have amounted to a little over $47,500,000, and it is of interest to record that most of the lines have been constructed by Bulgarian contractors. The total number of employees, apart from the staff of the Oriental lines, is just under 2,400.

AN ANALYSIS OF STEEL INGOT MANUFACTURE.

The Influence of Common Defects on the Quality of Rails and Structural Material and Means for Correcting Them.

By Bradley Stoughton,
Consulting Engineer, New York.

Defects in steel ingots and castings may be the consequence of faulty manufacture previous to the ingot stage, of faulty manufacture during the ingot stage, or of prevailing circumstances which are not faults in manufacture; or they may result from a combination of all of these different conditions. Any one of the recognized defects may be so deleterious as to unfit otherwise excellent steel for safe use. The truth of this is being appreciated today to a greater extent than it ever has been before, as evidenced by the discussion at the conference between representatives of railroads and steel makers in New York City a year ago, the four notable papers on sound ingots before the British Iron and Steel Institute in May and in September last, the recent New York meeting of prominent railroad engineers and steel metallurgists to listen to Talbot's description of his process, the interesting discussions at international engineering congresses during the past year, and, finally, the exhaustive report of the committee on Rails and Equipment of the National Association of Railway Commissioners.

The situation, as it relates to steel for rails and structural shapes, has been stated by the president of the American Society for Testing Materials, as follows: "Without sound and homogeneous ingots it is impossible to produce sound and homogeneous rails." And the meaning of "soundness" is defined by the committee on Rails and Equipment, thus: "Sound ingots: Probably the main end to be secured by improvements in manufacture is the production of sound ingots. It has been proved that sound rails cannot be made except from sound ingots. Defective spots in the ingot due to slag, blowholes, piping, and segregation will not be removed in rolling."

In order to make complete the committee's catalog of defects, we should add the presence of combined gases, such as nitrogen and carbon monoxide. We should also divide the defect described as slag into its two normal parts, oxidized substances and sulphide enclosures. We then have the full list of six ingot defects, which, with phosphorus, comprise all the ills to which forging steel is ordinarily liable, up to the period when it is rolled or forged.

Phosphorus is taken care of by means which are beyond the scope of the present paper, and the same may be said of the special microstructural difficulties to which steel castings are subject. Solid oxidized enclosures, entrained sulphides, blowholes, combined gases, pipes and segregation, will sufficiently occupy all the attention we can give here. As it is evident from the discussions to which we have referred, and especially from the report of the committee of the National Association of Railway Commissioners that the harm done by these different defects and the means for their correction or prevention are not generally understood, this study was undertaken with the object of placing on record what information is already available, and, if necessary, amplifying the data collected. As an example of the need of this, we note that Talbot, ignoring all ingot defects except pipes and blowholes, writes as follows, in his address before the American Institute of Mining Engineers: "The cost of the aluminum addition is very small; with silicon it is considerable, and with ferro-titanium it is large, to obtain the same result. . . . . All these de-oxidizers have the same effect, when used in the necessary varying quantities to produce this."

We propose to show that the prevention of blowholes is not the only purpose of adding aluminum, silicon, ferro-titanium, and other "physics" or "cleansers," that widely-different effects are produced by them severally, and that their relative effectiveness in each respect also varies greatly.

SLAG ENCLOSURES.

The chemical analysis of slag enclosures shows that they originate either directly or indirectly from the oxidation of iron and its constituents during the process of conversion into steel. Ziegler suggests that the oxides may be soluble in the liquid steel, but this view is not favored by Heyn and Rosenhain*, who have considered it at length. It seems more probable that the oxides of iron, silicon, manganese, aluminum, phosphorus, and calcium are in the liquid bath in the form of emulsified particles which will be held in suspension for a long time unless coagulated and removed by gravity. A hindrance to their elimination by natural means is the existence of a strong surface tension between the liquid steel and the solid oxide enclosures. That gravity tends to remove them is indicated by their presence in greater proportion at the top of ingots than elsewhere. This distribution seems indeed to argue against the solubility theory without, however, being entirely conclusive. Perhaps the oxide of iron at least may be soluble, and the other oxides, which originate chiefly because silicon, manganese, aluminum, etc., is added to decompose iron oxide, are themselves entangled before they have a chance to escape. It is the generally-accepted opinion, based on chemical analysis and other data which are summarized by Hibbard*, that most of the slag enclosures arise during the recarburizing of the steel. That some arise at other times is indicated by the occasional presence of calcium oxide.

The prevalence of slag enclosures is much more universal than is usually supposed, and all authorities who have expressed themselves on the subject, seem to take a certain amount of such inclusions for granted. The presidents of the two largest rail producing companies in America include this defect as among "unavoidable contingencies of manufacture," and the president of the third largest producer gives a list of physical defects, including: "Pipe, *abnormal* slag inclusion, etc." (The italics are mine.) Acid steel seems to be less liable to the defect than basic steel, but even electric steel is adversely affected, according to Arnou, Girod and others. In short, slag inclusion is an impurity which must be reckoned with in all steel which has been purified by oxidation, and especially in all steel which has been recarburized.

More than 20 years ago, Kreutzpointer called attention to the bad effect of slag enclosures on the resistance of steel to "fatigue," while the investigations of Rosenhain, Heyn, Wedding and Law, and those of Howorth, Bannister, Oberhoffer, Job, Primrose, Fay, Matweieff, Wickhorst, Dudley, Packer, Masselon and Mars, prove beyond question the dangerous influence of these foreign bodies, not only in causing steel to be frequently brittle and unreliable, but more especially in creating microscopic fissures and flaws (generally in the interior of the steel) which continuously develop under the strains of service and often cause the sudden rupture of steel which withstood a severe test for acceptance. This ill effect of the foreign oxides is dependent not so much on their size or amount, as on their mode of occurrence between the pearlite

*International Congress for Testing Materials, New York, 1912.

crystals of the steel, where they lessen the toughness of hypo-eutectic steel by interfering with the intercrystalline ferrite upon which this toughness so largely depends, and where they increase the fragility of hyper-eutectic steel due to the intercrystalline cementite. This mode of occurrence is probably the reason why slag enclosures are more dangerous to steel containing from about 0.50 to 0.75 per cent. and more of carbon (rail steel, spring steel, etc.), because the ferrite envelope in these steels is so thin that a slag enclosure may entirely break up its continuity. In steel of lower carbon, the slag bodies may be wholly enclosed in ferrite grains which will therefore act to some extent as a cushion to their brittleness. When it becomes generally recognized that the mode of occurrence of the slag, rather than the presence of an abnormal amount of slag, may be the cause of a "slag-fracture," and when engineers have learned to know the effect of slag in causing "seams," "streaks," and "laminations," we shall have a great deal more data on the ill effects of this impurity. James E. Howard, engineer-physicist of the Bureau of Standards, writes as follows, after referring to stresses which rails must bear in service:

To meet these conditions the metal of the rail should be structurally sound, but to attain structural soundness and uniformity in the finished rail certain conditions must prevail in the ingot and during the reductions in the rail mill. Chief among these is the elimination of slag inclusions in the ingot, which, starting in a globular form, become acicular in the rail and oriented parallel to its axis.

Mr. Howard and other engineers have also laid special emphasis upon the observation that interior fissures are more liable to develop in chemically hard steel than in softer steel, and are oftener met with in open hearth steel (basic) than in Bessemer steel (acid). The committee of the Association of Railway Commissioners assign as one cause of broken rails: "Internal transverse fissures which develop without outside evidence until the final break occurs". . . . "The most dangerous form of rail failure."

Engineers Cushing and Young, of the Pennsylvania Lines, assign the presence of entrained slag in 19 defective open hearth rails which showed these transverse fissures, as the "principal" and "fundamental" cause of the defect, and Dr. Dudley, of the New York Central Lines, is a prominent advocate of the necessity for eliminating slag as one of the chief means of obtaining good rail and structural steel. The engineers of the Harriman Lines, whose reports on rails are among the most thorough and authoritative available, class slag seams with pipes, as follows:

All rails are classed as "piped" which show in the fracture a seam or lamination; while this may not always be due to pipe, but may be due to slag or gas in the lower part of the ingot, the effect is the same.

And W. H. Wickhorst writes as follows:

The split head failure consists of an internal crack in the interior of the head running lengthwise of the rail anywhere from a foot or two to several yards in length. This type of failure is confined almost entirely to metal showing considerable internal segregation of carbon and phosphorus, attended more or less with laminations and slag seams.

Many rail and structural steel failures have been traced directly to defective metal due to slag seams, and many other failures, to metal showing streaks, seams, and laminations. J. E. Howard says: "An overwhelming majority of rail failures is reported as due to base fractures—fractures which disclose the presence of streaks and seams in the steel." One engineer ascribes this type of defect to rolling rails at too low a temperature, but let us hope that this opinion will not cause an increase of the already dangerously high rolling temperature, especially as the weight of evidence seems rather to indicate slag seams as the cause of these laminations—if not directly, then partly by direct influence and partly by the effect of red-shortness which slag enclosures produce. Hibbard thinks that the hot-shortness caused by slag enclosures is even greater than the cold-shortness so produced, while Stead, Campbell, Rosenhain, and others have shown that these foreign bodies also have the bad effect of hindering the refining of steel by annealing. Heyn has shown that enclosures of Al_2O_3 in mild steel, due to deoxidation by means of aluminum, can produce extraordinary red-shortness, and I have traced the failure of a high-carbon, heat-treated steel to the same cause, the alumina in this case being spread out in the form of a web, or thin cloud, made of microscopic specks, through which the fracture extended.

The commonest oxide enclosure is the silicate of manganese, and this seems to be often combined with the sulphide of manganese in a sort of double compound. Besides these bodies, the silicate of iron, and more complex slag compounds containing silicates of iron, manganese and lime, with alumina, sulphur and phosphorus frequently occur. Finally, the simple oxides of iron, manganese, silicon, aluminum and other elements occur separately, or combined together in various combinations which have been analyzed. Several such analyses are given in Table I, but it is not certain that these represent anything more than the composite analysis of several different enclosures occurring in the same steel, because all the bodies are usually distributed in such minute particles that chemical analysis of any one of them would be impossible. Indeed, they vary all the way from specks scarcely visible under the microscope to pieces easily discernible by the naked eye. Methods have recently been studied, however, for testing some of the commonest enclosures under the microscope, in order to identify them, as to whether they may be oxides or silicates of iron or manganese, etc. A very important property of these oxide enclosures is their melting-point in relation to the melting-point of steel, because, if the enclosures become solid before the steel is frozen, they will not only fail to coalesce into larger globules which more readily escape from the bath, but also they are not wet by the liquid steel, and the consequent strong surface tension makes their upward passage through the metal slower and more difficult. Since silica and some of the silicates, especially if made less fusible by the presence of alumina, have a higher melting-point than mild steel, we can readily understand why they often become entangled therein, and also why any agent which lowers their melting-point will greatly assist in their elimination.

It would therefore seem to be the fluxing property of titanium oxide on silicates and other oxides which is the cause of its well-known effect in eliminating slag enclosures from steel ingots. Rossi has shown that titanium oxide, when properly proportioned, lowers the melting point of silicates, and its fluxing effect on clays and other minerals has been noted by many observers. The effect of a "cleansing" addition of titanium to steel ingots is shown in the accompanying photographs. In order for this effect to be realized, the titanium first attacks oxides of other elements present in the ingot—for example, protoxide of iron, manganese and carbon—and, by reducing them, deoxidizes the bath and forms titanium dioxide, TiO_2. This dioxide then

TABLE I.
ANALYSES OF OXIDE ENCLOSURES.

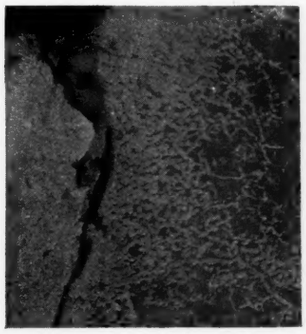
	Al_2O_3	MnO	SiO_2	FeO	Fe_2O_3	CaO	P_2O_5	S
By Jaeger, S. & E. XXXIII	.....	45.90	36.75	18.27	.....	.....	.....	.....
By Jaeger, S. & E. XXXIII	.....	43.40	37.70	18.36	.....	.....	.....	.....
By Neu, S. & E. XXXIII (Added Al. in ingots)	37.50	29.15	28.80	.....	.....	.....	0.25	.....
Hibbard (1), (Bessemer, pipe steel)*	?	38.66 (Mn)	7.95	?	.....	.....	0.043 (P)	2.51
Hibbard (1), (Acid o. h. boiler steel)*	4.00	48.50 (Mn)	20.98	15.96 (Fe)		.....	Trace	0.39
Hibbard (1), (Basic o. h. boiler steel)*	15.08	36.00 (Mn)	17.14	15.35 (Fe)		2.04	0.03 (P)	0.16

*Scum of oxide enclosures from ingot tops.

fluxes any oxides or slags existing in the metal, assists them to coalesce and thus removes them from the steel. The steel bath should be left for at least three minutes in Bessemer steel and eight minutes in open hearth steel, after the titanium addition, in order that this "washing out" of the enclosures may be completed. Between half a million and a million tons of steel were treated in this way in America during the year 1912.

Hibbard proposes another method of removing the slag

Top of Head of Bessemer Rail.



Edge of Flange of Open Hearth Rail.

Top of Head of Open Hearth Rail.

Web of Open Hearth Rail.

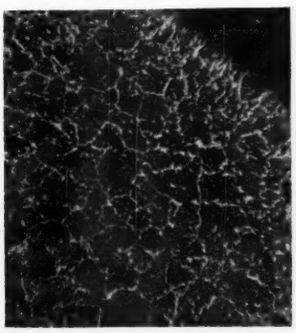
Photomicrographs of Slag Inclusions in "Uncleansed" Steel.

enclosures, but describes the results as only "tolerable." This method is to precipitate and coalesce the solid bodies—Hibbard calls them "sonims"—by means of a sufficiently large manganese addition, and then allow time for them to rise to the surface. Agitation, "working out," "shaking down," and similar practices aid this removal, he says. Furthermore, he

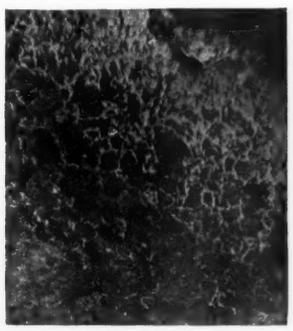
"Uncleansed." "Cleansed."

Sulphur Prints of Open Hearth Rail "Cleansed" and "Uncleansed."

finds that sonims are removed better if the steel is recarburized in the furnace, than if it is recarburized in the ladle. While the fluxing effect of manganese oxide on silica and silicates is undoubted, nevertheless all our evidence goes to show that manganese oxide, manganese silicate, and manganese sulphide, are the commonest of the solid enclosures, and, as such, are deleterious to the steel. To deliberately increase the amount of this "sonim-forming" body would seem to be working in the wrong direction, unless the results are more efficacious than Hibbard describes them to be.

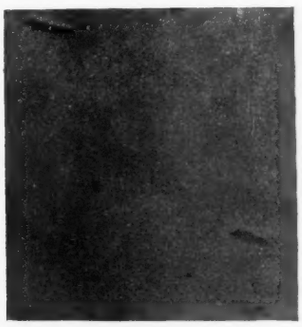


Top of Head of Bessemer Rail.



Edge of Flange of Open Hearth Rail.

Top of Head of Open Hearth Rail.

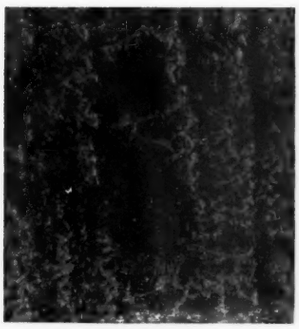


Web of Open Hearth Rail.

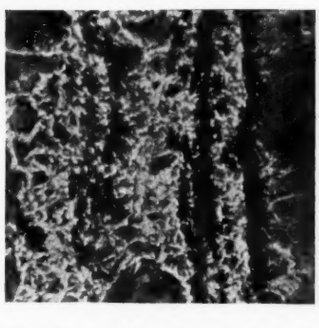
Photomicrographs of Steel "Cleansed" with Titanium.

Likewise, the addition of aluminum for recarburizing is seen to be dangerous practice, because aluminum not only forms a deleterious enclosure by itself, but it increases the viscosity of other solid enclosures and thus hinders or pre-

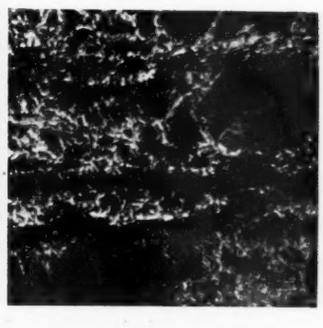
Magnification 200 Diameters, Unetched.



Magnification 200 Diameters, Etched with Picric Acid.



Magnification 200 Diameters, Etched with Picric Acid.



Magnification 200 Diameters, Etched with Picric Acid.

Photomicrographs of Alumina in Forged Steel.

vents their coalescence and removal, besides making the "sonims" freeze more quickly and thus increasing their surface tension against the liquid bath. To add aluminum in the ladle is worse than adding it in the furnace, and its addition in the ingot may be followed by grave consequences. Deoxidation by aluminum in ingots is a practice which can only be required when the previous manufacture of the steel was improperly or neglectfully performed; such addition is wrong and is now forbidden by specifications of several large consumers.

SULPHIDE ENCLOSURES.

Sulphides entrained in steel ingots or castings produce an effect like in kind to that already discussed under the head of oxide enclosures. The sulphide inclusions are, however, more difficult to remove from the finished steel, but their ill effects are easier to mitigate. Manganese sulphide is much less injurious to both the hot—and the cold—properties of steel than is iron sulphide, so that the addition of sufficient manganese to liquid steel will lessen the evil, and will also, to a limited degree, bodily remove some of the entrained sulphide if the bath is left in a quiescent state for a short space of time. The compound so formed is the sulphide of manganese, MnS, and also, according to the recent research of Roehl, a double sulphide of iron and manganese, $Fe_3Mn_2S_5$. Both the sulphide of manganese and the double sulphide freeze at a much higher temperature than the iron-sulphur eutectic, so that the addition of manganese also moderates the segregation. Nevertheless, manganese sulphide itself segregates to some extent, and forms globules which, while reckoned as a lesser evil than iron sulphide, is still an evil. It makes steel somewhat red-short, has been known to cause serious failures and to initiate fissures and cracks, and has a bad effect on the corrosion of steel by producing local differences of electric potential. The basic processes of steel manufacture have been the greatest remedy for sulphide evils by removing sulphur almost to harmless traces. It is of great importance, however, that the resulting basic steel be thoroughly deoxidized and quieted, in order to limit the segregation and thus keep the sulphide down to moderate proportions at all parts of the steel ingot, especially as Stead has recently shown that sulphide of manganese is a special danger to steel which has not been deoxidized, because it prevents the perfect welding of blowholes which would otherwise be entirely eliminated.

BLOWHOLE PREVENTION.

A lengthy discussion of the cause and prevention of blowholes seems scarcely warranted here, since it is now well established that blowholes may be entirely prevented by a thorough deoxidation of steel by means of aluminum or titanium. Stead says that these two metals not only prevent blowholes, but also absolutely prevent the evolution of gas. Vanadium and silicon likewise react effectively in these respects, and manganese and carbon, by deoxidizing the metal, greatly lessen the tendency to form blowholes. The gases ordinarily found in blowholes are: carbon dioxide, carbon monoxide, hydrogen, nitrogen and hydro-carbons. To prevent these gases forming blowholes, we must either eliminate them from the steel entirely and also eliminate the agents which form them anew, or else we must partially eliminate and partially cause to dissolve by increasing the solvent power of the steel for them. Iron oxide is the agent which chiefly forms blowhole gases anew, because this compound reacts with carbon when the temperature falls, and particularly when the metal is so viscous that the gas bubbles cannot escape from it. When the oxides of carbon begin to pass off, they carry with them hydrogen and nitrogen which might otherwise have remained dissolved in the steel without producing a blowhole. Thus the complete elimination of iron oxide is the secret of blowhole prevention. Doubtless this is what Talbot intends by his statement that aluminum, silicon and ferro-titanium all have the same effect when used in the necessary varying quantities. However, aluminum and titanium are admittedly more powerful in proportion than silicon, and the latter element has the disadvantage, when used in connection with a basic process, that the first ingots may be quite free from blowholes, while the later ones may be porous on account of the absorption of the silicon in the interval, by the basic slag.

If steel is so thoroughly deoxidized that no blowholes form, the volume of the pipe will be correspondingly increased, and, conversely, if we allow a sufficient number of blowholes to form, the pipe may be almost entirely avoided. For this reason, many manufacturers desire a small number of blowholes to form, so that a deep pipe will not necessitate a heavy discard from the ingot. This practice is open to certain difficulties and dangers, because the resulting blowholes are not always welded up in the subsequent rolling or forging of the steel. It is well known that a slight difference of temperature of the steel when cast, the spattering of steel against the sides of the ingot-mold during teeming, a slight over-oxidation of the steel during conversion, or error in adjusting the recarburizer, may upset the calculations to such an extent as to produce an excessive number of blowholes, or bring the blowholes so near to the skin of the ingot that they will form "fish tails" on the rolled piece, or will become oxidized so as, at the best, to weld up only in small degree. And, even if the blowholes are all well below the surface, the presence of manganese sulphide may prevent complete welding, as already noted, and thus may render the steel doubly liable to corrosion.

GASES IN STEEL.

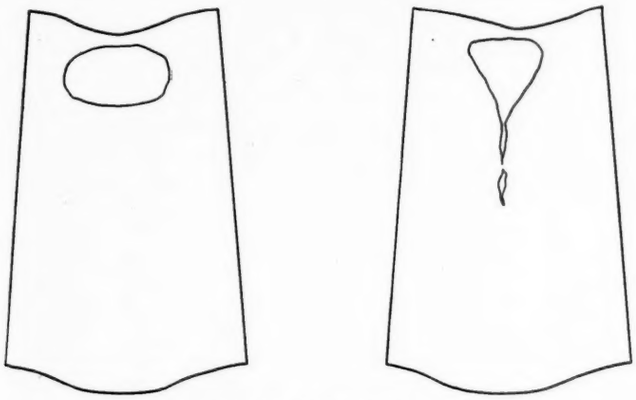
The same gases found in blowholes are also found occluded in the steel, or combined with it, where they reduce both the strength and ductility. This is specially true of hydrogen and nitrogen, as well as oxygen, although whether this latter element produces its ill effects in all its different forms,—i. e., as solid oxide enclosures, as occluded gas, and as oxides of carbon,—or only in the first form, is not yet known, because chemical analysis has not kept pace with practice so as to enable us to differentiate between the different combinations. Titanium and vanadium both seem able to get rid of it in both of its gaseous forms, and the same result is obtained by a super-refining in an electric furnace. Hydrogen is still an unconquered impurity; it may be removed by repeated heatings in vacuo, but does not seem to be effected by the usual remedies applied during the ingot-stage of steel manufacture, further than that silicon, aluminum and titanium cause it to remain dissolved in the steel instead of forming a blowhole. Nitrogen is removed in large part by titanium, which has a greater affinity for this inert element than any other known substance. Vanadium, too, perhaps, causes a partial elimination of this gas, whose effect on the steel is embrittling and harmful.

PIPES.

Titanium, vanadium, aluminum, silicon, and any other element which decreases blowholes, will increase the volume and depth of pipe. It is therefore often stated as an axiom that the purer the steel the larger will be the pipe, and many engineers prefer to see the pipe comparatively large, with the implied assurance that all the impurities are located in one part of the ingot and that this part can be cropped off. It is important, however, that we consider not only the volume of the pipe, but also the depth to which it extends. That is to say, we may have a large pipe which is located at a high point in the ingot as shown at the left, or we may have a pipe which is no larger, but which extends to a greater depth as shown at the right. The deep pipe is correspondingly dangerous because it requires so much more steel to be cut off before it will be eliminated and because it will not be so easily noticed in cropping and may thus remain as a perma-

nent defect in the steel. Aluminum and silicon have a special influence in increasing the depth of piping, on account of their causing the steel to pass quickly from the liquid to the solid state, while titanium and vanadium tend to lengthen the period of solidification and thus decrease the depth of the pipe in relation to its volume. Aluminum has a further ill-effect on the depth of the pipe, in that, if added in too large proportions, it segregates and may produce a pipe extending even from top to bottom of the ingot. In recent years many railroads have paid a bonus on rails in order to secure greater safety by having the upper 20 per cent. of the ingot discarded, so as to get rid of both the pipe and the worst of the segregation, but even then failures occur from unsound steel. Other roads have refused to pay the bonus on the ground that the price asked was disproportionate to the additional cost of manufacture and that a proper inspection would insure cropping of the ingot until all the defective metal was removed.

Getting rid of the pipe by "centrifugal casting" and by "liquid compression of the ingot" have been tried in various works, and the latter practice is in vogue on a large scale,



Two Types of Pipes in Ingots.

particularly for ordnance steel, both in Europe and America This "liquid compression" is too slow and too costly of installation for use in connection with the manufacture of steel on a large scale, such as structural steel and railroad steels, but much interest has been shown recently in processes for the production of "pipeless ingots," and three new devices have been made public: heating the top of the ingot, by Sir Robert Hadfield; semi-liquid compression in a rolling mill, by P. H. Dudley and Benjamin Talbot, and heating and stirring by thermit, by Dr. Goldschmidt. The procedure in all these processes should be, and is, to concentrate all the impurities in the pipe as far as possible, and then to eliminate this pipe by one of the devices mentioned.

SEGREGATION.

This subject is also too well known to require extended discussion here. That segregation is an evil in boiler plates and pipes, and all material which is subjected to corrosion, as well as in rails and structural steel, wire, and castings, and in 90 per cent. of all other steel made, is no longer doubted by any one. It is also an evil met with more often now-a-days, when the open hearth process, with its larger size of ingots, is predominant, than when ingots were much smaller in section. The most beneficial remedy for segregation is to deoxidize and quiet the steel, and researches have proved that aluminum and titanium are especially effective in this respect. Manganese and silicon themselves segregate and therefore are more of a detriment than a remedy. Vanadium is quieting to steel, and, for this reason, is probably a preventive of segregation.

COMPARATIVE INFLUENCE OF DIFFERENT "CORRECTIVE AGENTS" ON INGOT DEFECTS.

In Table II, I have given a summary statement of the different ingot defects that have been discussed and the relative effectiveness in preventing or remedying each one, of aluminum, silicon, manganese, titanium and vanadium. This table brings out very strongly the variation that exists in these different "corrective agents" or "physics." The role of manganese is shown up with especial clearness, and many will be surprised to see how much evil has to be redeemed by the influence of manganese in counteracting the bad effect of sulphur and oxygen. With the new agents which take care of oxygen even better than manganese can, it is possible that manganese might be relegated to the side-lines if it were not for the necessity of remedying the effect of sulphur, especially in view of the ill effect of manganese in increasing brittleness and liability to corrosion.

TERMINAL SERVICE.*

By W. M. Prall,

Superintendent of Car Service of the Pennsylvania Lines West of Pittsburgh.

The first problem at the terminal is the organization of a system of records that will in no way delay the car in its movement, but will convey the necessary information to the end of a check, so that the agent can instruct for, and later establish delivery. The agent must be held to responsibility for the conveyance of all necessary information to the yard master and his subordinates, with one object in view—the continuation of service to the end of the fulfillment of the railroad's obligation for transportation.

In road service, there is a complete system of reporting. In terminal service the system of reporting is incomplete, and as a rule the reports are made to, or through the road official. It has been demonstrated that by the introduction of a proper record book at terminals, in which are entered each and every day every car received for local delivery, and every car received with the privilege of distribution, or reconsignment, or reshipment, with the proper checking and reporting, that if salaries are established to the end of the employment of intelligent car service clerks and delivery clerks, an ever-present supervision can be maintained over the movement of the car. And there is no reason why a system could not be established where every car in through service, handled in the terminal, and every car handled through divisional points, could be recorded and checked, so that any car delayed beyond 24 hours will be reported delayed, with an addi-

*From a paper read before the Railway Club of Pittsburgh, January 24.

TABLE II.

INFLUENCE OF CERTAIN "CORRECTIVE AGENTS" ON DEFECTS IN STEEL INGOTS:

IN THE RELATIVE ORDER OF THEIR EFFECTIVENESS.

Prevents Blowholes	Removes Oxides of Iron and Manganese	Removes All Oxides and Slag Enclosures	Removes Nitrogen	Breaks Up and Removes Sulphide of Iron	*Causes a Pipe*	Hinders Segregation
1. Aluminum	1. Titanium	1. Titanium	1. Titanium	1. Manganese	1. *Aluminum*	Aluminum
2. **Titanium**	2. Silicon (Weakly)	*Hinders*	2. Vanadium	2. Titanium	2. *Silicon*	Titanium
3. Silicon	*Hinders This*	*Removal of All*	(?)	(?)	3. *Titanium*	Vanadium
	Removal	*These Enclosures*			4. *Vanadium*	*Promotes Segregation*
4. Vanadium	1. *Aluminum*	1. *Aluminum*			5. *Manganese*	1. *Manganese*
5. Manganese	2. *Manganese*					2. *Silicon* (*Sometimes*)

FOOTNOTE.—Words printed in *italics* indicate a detriment to the steel.

tional report of all cars delayed beyond 48 hours, to be made to the central offices.

A proper check of cars materially reduces the expense of the switching service. Engine delay amounting to 30 minutes a day justifies a sixty dollar clerk to make the necessary check and convey necessary information. As the delivery clerks can not be constantly supervised, it is necessary, to the end of conservation of switching expense, to employ intelligent clerks and pay them a proper salary.

During the last twenty years there has been a gradual improvement in the understanding of terminal necessities, and here and there throughout the country we find terminals in charge of a general agent, or in charge of a superintendent of terminals, they having authority over the entire terminal. But we do not find a uniform understanding of the possibilities of improved service through demurrage rules. The railroads fail to understand the benefits that can be derived in improved service by the constructive placement of cars. It is the pressure on the car already placed, to the end of that car's unloading, that results in continuous movement. The railroads are badly handicapped because consignees are protected by present laws, and by officials in many states, in their insistence that all the obligation for service is with the railroad. A car moves on a private siding just as well as it moves in the terminal or on the main line, and the car cannot move properly on the siding unless the siding is properly organized; unless the consignee has prepared his siding with roadways, runways, warehouses, etc., to unload the car within the time proper for its unloading. Consignees should not be protected in their demands for supplementary service that was not contemplated in the original contract; they should realize that unless a car can be immediately placed, there must be one or two additional switches, and that the general public bears the expense of those additional switches. A business that increases its output 20, 40, 50 or 100 per cent. without an increase in the facilities for loading and unloading, is adding a burden to service; a burden that should be accepted by themselves, and if accepted by themselves would result in benefits to themselves. The old idea that because of the volume of business being of importance to the railroad, the railroad should perform additional and unwarranted service, should be exploded.

It seems as if rebating has been eliminated, excepting in the shape of unwarranted and supplementary additional service; it should be as well eliminated in additional service as in repayment of moneys. The Interstate Commerce Commission, in its later rulings, has exhibited a knowledge of certain conditions surrounding terminal service that is most gratifying. Witness the decision in the Detroit reconsigning case. Witness the decision in the California case. Witness the decision which applied purely to the interchange of cars between railroads, in which a railroad is obliged to perform its service in accord with the contract, making deliveries to connecting lines even where the connecting line fails in an appreciation of the rights of ownership in the car, and notifying the railroads that they must formulate some rule or regulation to the end of re-taking their cars.

Many terminal engines are delayed from two to six hours because of the failure of the connecting line to so arrange that when the delivering line runs through the connection with a view to placement of cars on the tracks of the receiving line, there are no tracks on the receiving line on which the cars can be immediately placed.

A prolific source of car delay, is the method of commission men handling perishable freights, who assume the right to withhold cars from the market, always provided the car is held on a rising market, there being authentic cases of delays of 10, 20, 30, 40 and 50 days. If the shipper were relieved from responsibility excepting for the gathering, draying and loading, and if the consignee were held to responsibility for the immediate payment of freight charges, and in case of failure to pay that the railroad should be held to responsibility for the sale of the lading for whomever it might concern, the result would be a larger consumption of fruits and vegetables, to the benefit of the health of the general public, and it would conserve the interest of the shipper—because his consignments would be sold while they were still marketable.

In the early days of railroading, when the railroad transported a car from station A to station B, if the freight was not immediately unloaded from the car by the consignee, the railroad unloaded it on the ground and throw a tarpaulin over it and took the car for the service for which it was built. That was the old Drayage or Cartage law. The contract was clean-cut. The railroad was protected in confining itself to transportation. Later, for reasons best known to the railroad officers of 30 or 40 years ago, special privileges were granted to consignees, and among the special privileges it was conceded that the consignee could hold the car for his convenient unloading. In 1888, the conditions were so disastrous to everybody that the railroads, in fear and trembling, introduced demurrage.

A survey of the present situation is encouraging. There has been a gradual improvement in the understanding of the patrons of the railroads of their own necessities for service, together with a gradual understanding that the service to them individually is entirely dependent upon their organization.

The Interstate Commerce Commission is gradually attaining to an understanding of some of the terminal evils, and many of the present evils will be eradicated. The practice of reconsigning, distributing and billing of cars for a market are present necessities in order to properly conduct the business of the country, but the time allowances and the privileges should be in accord with the needs of business. The great difficulty in administration is in determining what should be allowed, and what is an unnecessary allowance. Supplementary service can never be performed at no expense. No conveyance of property rights can be made without an equivalent. And the courts have invariably maintained, in giving consideration to transportation obligations, that individual convenience is subservient to the public good.

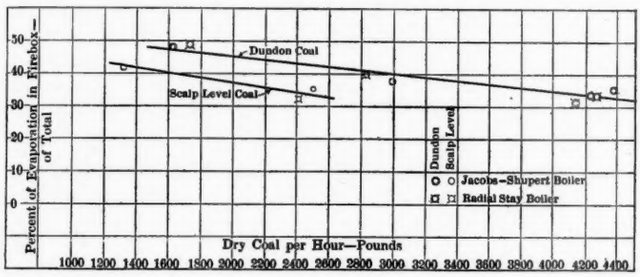
As the demurrage charge is in the nature of a penalty for breach of contract, it partakes of the nature of a police law, and, consequently, consideration should be given to mitigating circumstances under untoward conditions. In regard to the average rule, I have always maintained that it is a step backward. That is a rule that can be, and is used to effect unnecessary detention to certain specified cars, that detention being entirely within the control of the consignee or consignor. Under the average rule, car efficiency is not maintained, and cars are abused by certain patrons of the railroads in service, without compensation. The average rule is a special contract, and is in contravention of the decision of the Supreme Court of the United States, as rendered by said court in Opinion 215, in relation to the Carmack Amendment.

Accidents in England.—For the three months ending June 30, 1912, the accident record of the railways of the United Kingdom is in some important respects more satisfactory than that for the corresponding period of 1911. The number of fatalities to employees from accidents other than train accidents shows a diminution from 90 to 50. Especially noteworthy is the fact that there were no coupling fatalities, while the total number of switching fatalities declined from 23 to 4, and there was a decline from 31 to 11 in the number of fatalities to men working on the permanent way. On the other hand, 24—as against 15—were killed while walking, crossing or standing on the line, of whom 11 met their death while walking to or from work. As in the corresponding period, no employees were killed in accidents to trains, although 24, as against 18, received injuries. Four passengers were, however, killed in one train accident during the second quarter of 1912, compared with one passenger in the corresponding quarter of 1911. Comparing the number of accidents, it will be found that there were 13 against 15 collisions in which passenger trains were concerned, 14 freight train collisions, 6, as against 7 buffer-stop collisions, 16 against 23 passenger-train derailments, and 37 against 49 derailments of freight trains or light engines.

RESULTS OF COMPARATIVE FIREBOX TESTS.

Summary of the Report of Those Recently Conducted at Coatesville, Pa., with a Brief Reference to Methods Employed.

The complete report of the comparative tests of the Jacobs-Shupert and the radial stay boilers, which were made early last year, has been submitted to the Jacobs-Shupert United States Firebox Company, Coatesville, Pa., by Dr. W. F. M. Goss, dean of the College of Engineering, University of Illinois, under whose direction and supervision they were conducted. The program for the comparative tests provided for three series, designated as A, B and C. The object of series A was to determine the relative amount of heat absorbed by the fireboxes and the tubes of the two boilers under similar conditions of operation; series B consisted of evaporation tests of the two boilers; and series C was intended to determine their relative



Ratio of Evaporation in Fireboxes to Coal Burned per Hour.

strength under low water conditions. A report of the latter was given in the *Railway Age Gazette,* June 28, 1912, page 1595.

The two boilers, both of the extended wagon top type, were constructed under the supervision of Dr. Goss and were as nearly as possible identical. The following are the principal dimensions:

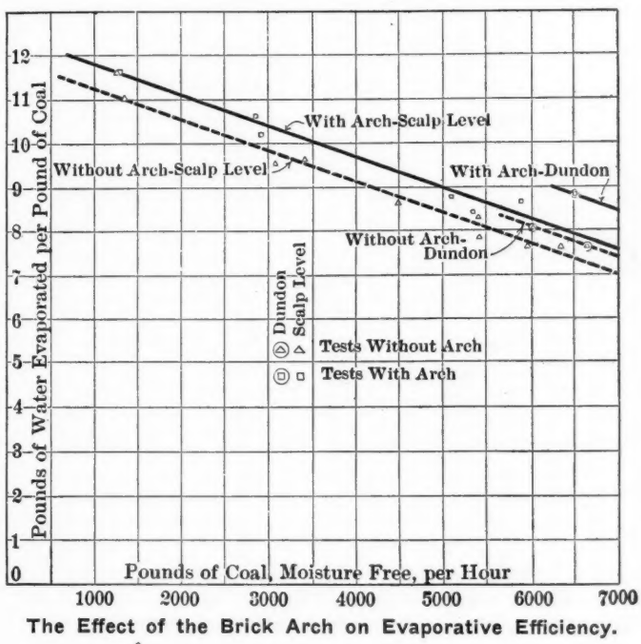
	Jacobs-Shupert.	Radial stay.
Diameter at front end, in.	70	70
Diameter at throat, in.	83⅞	83⅞
TUBES.		
Number	290	290
Length, ft. and in.	18—2	18—2
Diameter, in.	2¼	2¼
FIREBOX.		
Length, inside, ft. and in.	9—1⅝	9—1⅛
Width, inside, ft. and in.	6—4⅜	6—4¼
Depth, inside, ft. and in.	6—1⅞	6—2⅛
Grate area, sq. ft.	58.14	58.07
HEATING SURFACE.		
Side and crown sheets, projected area, sq. ft.	146.2	146.6
Side and crown sheets, developed area, used in all computations, sq. ft.	168.0	146.6
Total firebox, sq. ft.	230.8	206.7
Tubes, sq. ft.	2,759.0	2,759.0
Total barrel, sq. ft.	2,777.6	2,777.6
Total boiler, sq. ft.	3,008.4	2,984.3

In series A both the Jacobs-Shupert and the radial stay boilers were divided into two compartments by an extension of the back tube sheet to the outside shell. These compartments were connected only through the medium of the steam piping, the arrangement of which was similar to that of two boilers connected to a common steam header. Both compartments received heat from the firebox, but each was fed from a separate supply of weighed water and its output of steam was dealt with as though it were a separate boiler. The location of the partition was such that the heat transmitted by the back tube sheet was delivered to the barrel portion of the boiler and the evaporation from this portion of the firebox was weighed in with that of the tubes. Regarding this Dr. Goss says: "The observed data give the actual weighings of water fed to each portion of the boiler, and all items involving water evaporated, are deduced from these values, being based upon the observed results referred to the actual surface which was effective in bringing about the result. The deduced values covering the firebox performance have been obtained by multiplying the evaporation actually obtained by the ratio of the total firebox surface to the firebox surface effective in producing vaporization in the firebox-end of this boiler. The small increment, which by this correction is added to the observed evaporation of the firebox, is in the deduced results, subtracted from the observed evaporation of the barrel. The effect of this correction is merely to credit to the firebox and debit to the barrel the heat transmitted by the back tubesheet. These statements are, of course, applicable to both boilers."

Trouble was experienced, while the boilers were heating up, by the firebox end beginning to make steam much sooner than the barrel end. This steam passed over to the barrel, where much of it condensed. It was finally necessary to supply means of circulation between the compartments while heating up, which was done by connecting two washout plug holes by a pipe. Valves were provided to stop the circulation after both parts of the boiler were in action. In considering the results of this series, given further on, it would be well to bear in mind that the boilers were not working under service conditions.

In series A nine tests were made using oil as fuel and twelve using coal. There was considerable difficulty experienced in firing the oil so as to prevent deposits of soot on the heating surface. On this account Dr. Goss states that the results cannot be accepted as constituting a basis of comparison which admits of a high degree of refinement and for this reason no attempt was made to elaborate, through a complete heat balance, the computations of the oil-fired tests.

In the tests using oil as fuel the boilers were so operated as to give an equivalent evaporation of from 20,000 to 29,000 lbs. of



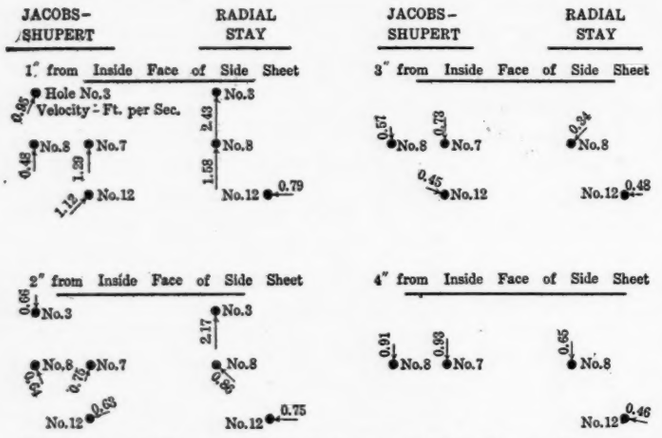
The Effect of the Brick Arch on Evaporative Efficiency.

water an hour, and the results indicated that each pound of oil produced an evaporation of 15.9 lbs. to 13.2 lbs. of water in the Jacobs-Shupert boiler, the amount diminishing as the rate of power increased. When 800 lbs. of oil were fired an hour, the tests showed 54 per cent. of the total evaporation as being due to the firebox heating surface; and with 2,200 lbs. of oil an hour, 40 per cent. of the total evaporation was from the firebox. When there was an equivalent evaporation of 40,000 lbs. of water an hour for the whole boiler, the evaporation per square foot of heating surface per hour was, for the barrel, 6.47 lbs.

and for the firebox 49.59 lbs. The ratio of heat absorbed per square foot of heating surface by the firebox, to that absorbed by the tube heating surface, was thus 7.6 to 1.

In the tests with coal, at low rates of power either boiler gave an equivalent evaporation per pound of coal of over 10 lbs. of water; and the evaporation was normally above 8 lbs. of water per lb. of coal for the entire series. This indicates a thermal efficiency from 8 to 10 per cent. less for coal than for oil. However, the brick arch was not used in this series. One of the diagrams shows the ratio of the total heat absorbed by the boiler to that absorbed by the firebox when coal was fired. Using Dundon (long flame) coal at a rate of 4,341 lbs. per hour, the equivalent evaporation of the Jacobs-Shupert boiler was 35,405 lbs., 11,982 lbs. being evaporated by the firebox and 23,423 lbs. by the tubes. The firebox developed 304 horse power, while the entire boiler developed 1,026 horse power. For the whole boiler, the average rate of equivalent evaporation per square foot of heating surface per hour was 11.77 lbs.; for the firebox alone 51.92 lbs. and for the barrel 8.43 lbs. The ratio of heat absorbed by the firebox to that absorbed by the tubes was as 6.15 to 1. The later tests with Dundon coal showed that when giving an equivalent evaporation of 20,000 lbs. of water an hour the Jacobs-Shupert boiler generated 8.3 lbs. of steam per pound of coal. Comparing this with 14.14, the weight of steam per pound of oil at the same rate, indicates that one pound of oil is equivalent to 1.7 lbs. of high grade bituminous coal.

Different fuels produced different results in the heat distribu-



Direction of Flow of Circulation and Velocity in Feet per Second.

tion, and Dr. Goss concludes that when giving an equivalent evaporation of 20,000 lbs. of water an hour, the proportion of the whole quantity of heat absorbed, which is taken up by the firebox of a Jacobs-Shupert boiler, is for oil 42 per cent., for long flame bituminous coal 42 per cent., and for short flame bituminous coal 35 per cent.

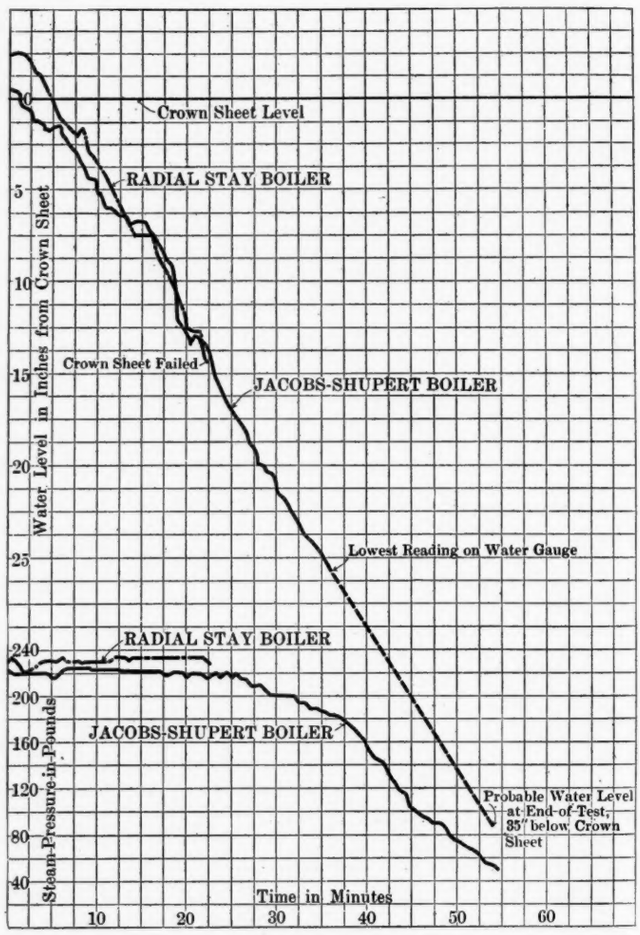
In retubing the boilers after the reconstruction of their fireboxes, preparatory to conducting the series B tests, the tubes were welded into the firebox tube sheet. This was done to prevent a tube sheet failure during the low water tests, series C.

Eleven tests were made on the two boilers in series B without a brick arch and eight with a brick arch. One test using Dundon coal was run on the Jacobs-Shupert boiler with the arch installed, the others being made with Scalp Level (short flame) coal. The diagram shows the equivalent evaporation with and without a brick arch.

Throughout the series the boiler efficiency was always highest when the least power was being developed. When burning 1,389 lbs. of dry coal an hour the efficiency of the Jacobs-Shupert boiler was 71.86 per cent., and excluding the grate, 79.75 per cent. When burning 6,314 lbs. of dry coal an hour, the efficiencies were 50.41 and 55.36 per cent. respectively. In the former case the boiler horse power was 443 and in the latter 1,393, while the equivalent evaporation per square foot of heating surface per hour was 5.08 and 15.98. The following table, which gives figures for the Jacobs-Shupert boiler, indicates the effect produced by increasing the rate of working of a boiler:

Pounds of coal fired per hour	1,389	3,419	5,930	6,314
Thermal units for each pound of coal:				
Absorbed by water in boiler	10,687	9,327	7,532	7,388
Lost by moisture in coal	48	34	37	33
Lost by moisture in air	49	53	114	54
Lost by hydrogen in coal	486	497	500	514
Lost by smokebox gases	1,979	2,731	3,992	4,675
Lost by incomplete combustion	78	...	...	...
Lost by cinders passing up stack	153	851	1,078	1,012
Lost by combustion in ash	1,187	679	291	185
Lost by radiation and unaccounted for	205	547	881	783
Total B. t. u. per pound of coal	14,872	14,719	14,425	14,654

The report states that the brick arch as a factor in boiler performance is always beneficial, its effect depending on the characteristics of the fuel. When the short flame coal was used, the use of an arch in either boiler increased the amount of water



Water Levels and Steam Pressures During the Low Water Tests.

evaporated per pound of coal 0.6 lb. Assuming either boiler to be fired with 6,500 lbs. of Scalp Level coal an hour, it would evaporate 7.35 lbs. of water per pound of coal without an arch and 7.95 lbs. with an arch, a gain of 8 per cent. in favor of the arch. With long flame coal the evaporation would be 7.7 lbs. of water per pound of coal without an arch and 8.7 lbs. with an arch, a gain of 12 per cent.

During the progress of the series A and B of tests, George L. Fowler conducted experiments on both boilers to determine the velocity and direction of flow, as well as the quality of the mass of the liquid at different points. For this purpose the water legs of the boilers were drilled with 15 holes. The principle of the operation was that of measuring the impact of the flow of the mass in the water leg on the mouth of a Pitot tube, by means of

the elevation of a liquid heavier than water in a U-tube. The proportions of contained water and steam were afterward determined by samples led off into a barrel calorimeter. The Pitot tubes were inserted in the firebox at the points where it was desired to make the measurements and could be moved through suitable stuffing boxes so that the opening in the tube could be placed in any desired position. The results of the investigation are shown in the diagram, the arrows indicating the direction of flow of the currents. Regarding the circulation tests, Dr. Goss says that in spite of the limitations which must be placed upon them, they are of great significance. Lack of time prevented these tests being carried as far as it was desired, but they indicated an almost complete absence of fore and aft movement of the water and that only enough water passes back to the water legs from the barrel to replace what the firebox evaporates.

In the low water tests, the water in the Jacobs-Shupert boiler dropped to the bottom of a special water-glass 25½ in. below the level of the crown sheet in 34 minutes after it had passed the crown sheet level. The test was ended 53 minutes after the water had fallen to the level of the crown sheet and when it was 40 in. below it, no failure having occurred. An inspection of the boiler showed all the effects of overheating except that the firebox was intact. In the case of the radial stay boiler, the crown sheet failed 17¾ minutes after the water passed the crown sheet level and when it was 14½ in. below it.

The principal conclusions drawn by Dr. Goss from the three series of tests are that the evaporative efficiency is the same for the two types of boiler; that in general their steaming capacity is the same but that the Jacobs-Shupert may be forced to higher power without danger of injury; and that the superior strength of the Jacobs-Shupert boiler under low water conditions permits it to endure overheating for long periods of time without failure, where the normal radial stay boiler quickly fails.

REGULATION OF RAILWAYS.*

BY W. W. FINLEY,
President, Southern Railway.

Our railway system has been constructed without any cost to the public treasury, except as to some of the earlier lines and the land grant roads, as to which the ultimate public benefits in the settlement of the country which they made possible were far in excess of the cost. We think of the cost of the Panama canal as a large amount of money, but it is only about one-fortieth of the amount of private capital that is invested in the railway systems of the United States without taking account of the large amounts that have been wiped out by civil war, bankruptcies, and reorganizations, and the other large amounts of earnings that have been put into improvements and betterments and have not been capitalized. It is not detracting from the importance of the canal to point out that an estimate made by a distinguished authority of the annual requirements of the railways of the United States for additional capital expenditures to enable them to keep pace with the growing demands for their service are from two to three times the total cost of the canal; that a single railway company distinguished for conservative and able management has invested in its property earnings that it might have distributed to its stockholders in an amount approximately sufficient to have built the canal; that the operating expenses of the railways would pay for the construction of five Panama canals in a year and leave a sufficient margin to fortify them and build a few battleships for their defense, and that the taxes paid by the railways in three years, if all paid into the United States treasury, would more than reimburse it for the entire cost of the canal.

State and federal governments have enacted legislation and provided administrative and judicial tribunals for the correction of wrongs that may grow up in the business of transportation by rail. This is a proper and salutary exercise of the authority of government growing out of the nature of the business of a railway company in carrying persons and property over a privately-owned highway devoted to public purposes.

With this regulation by the government which has had the effect of eliminating abuses, and, with the power in the government to search out and correct any abuses still remaining or that may develop, I feel sure that there cannot be anything wrong in the proposition that conditions shall be made such as to permit the fullest development of the transportation service of the country. On account of the public interest in efficient railway service this is as important to the public as to the railways.

A FAIR CHARGE FOR EVERY SERVICE RENDERED.

The first requisite, in my opinion, to the maintenance of this condition is that those tribunals that have been established to regulate charges shall recognize the right of the railway to make a charge for each service that shall be reasonable as measured by that service having fair reference to its value. This is a very different matter from fixing charges for service so as to yield a predetermined rate of net income—a thing which a full knowledge of the problem will, I am sure, demonstrate to be uneconomic and impossible. That the application of this standard, in specific instances, may be difficult should not excuse failure to apply it. It is being applied with more or less exactness in the practical every-day fixing of charges by the railways and in the cases before the commission and the courts involving the reasonableness of specific charges. Capitalization and other conditions on different railways differ so widely that a strict enforcement of the principle of a predetermined rate of income, even if it were possible, must necessarily lead to discriminations, territorially and otherwise. If the aggregate of charges on the basis of their reasonableness as measured by the service performed is such as to leave little to the owners of the property after the payment of operating expenses and taxes, that is their misfortune. If it is such as to leave them a larger profit, that is their good fortune. Small net income for the owners of a railway, whether the result of poor location, inefficient management, or other cause, will not justify charges that are exorbitant or unreasonable as measured by the service performed. Neither will large net income, due to fortunate location, efficient management, or other cause, justify a reduction of charges that are reasonably low as measured by that standard.

OPERATING EXPENSES AND RATES.

Various elements enter into the reasonableness of a transportation charge. I am not now endeavoring to cover the whole subject as to the proper bases of a transportation charge. I shall mention one of them this evening because it is one which is dependent in no small measure upon public opinion. This is expense of operation. On superficial thought this might seem to be a matter with which the public has nothing to do, but it is coming to be more and more controlled directly and indirectly by the public. One of the most serious problems confronting railway management in the United States and entering into the cost of service is that of constantly increasing taxes imposed by public authority. The aggregate payments for the past fiscal year amounted to more than $120,000,000. The rate of taxation per mile has increased fully 150 per cent. since 1890, and each year sees it mounting ever higher. Then there are requirements under the exercise of public authority in other ways that tend to increase operating costs.

The largest single item of railway expenditure, and one in which the public is concerned as bearing on cost of service and the reasonableness of an adjustment of charges for railway service, is that of wages. Railway service, in many of its branches, is most exacting, requiring a high type of manhood. Without men of this kind the American railway system could never have become the efficient transportation agency that it is today. It is

*Abstract of an address delivered at a dinner given by the Chamber of Commerce, New Haven, Conn., January 23, 1913.

right that such men should be fairly paid, and American railway employees receive wages much higher than those paid to railway employees in any other country and generally higher than are paid in any other employments in the United States calling for similar measures of skill and reliability.

In the adjustment of questions as to rates of wages and conditions of employment it is inevitable that differences should be developed between the railway companies and their employees. Such differences concern not only the railways and their employees, but the public as well, for the reason that a strike or lockout which would interrupt, or seriously impair, the efficiency of railway service would cause great inconvenience if not actual suffering to many persons.

The public interest in controversies between the railways and their employees has already been recognized by Congress in the enactment of the so-called Erdman law, which applies to those classes of railway labor having to do with actual train operation. In a controversy involving any one or more of these classes either the employing company or the employees may apply to the presiding judge of the commerce court and the commissioner of labor for mediation. If mediation is accepted by the other side the mediators then endeavor to bring them together in an amicable agreement. Failing in this, arbitration may be resorted to if both sides agree. There is nothing compulsory about the Erdman law at any stage of the proceedings until a controversy has been finally and voluntarily submitted to arbitration. Yet it has been the means of the amicable adjustment of a large number of controversies which, but for the proceedings under it, might have resulted in strikes.

But since the Erdman law has been on the statute books cases have arisen in which it was not availed of and strikes have resulted. Although the settlements arrived at in the cases in which it has been invoked have not always been entirely satisfactory to both sides, they have always been in the public interest to the extent that they have kept traffic moving, and I believe that the time has now come when we should go a step farther and make it still more improbable that a strike or lockout shall affect the transportation service of the country. Among those who favor further action there are differences of opinion as to the form which it should take, but even now the experiment of special boards, not provided for by the Erdman act, is being tried, and I venture to suggest that this may point the way to a final solution that will safeguard the interest of employers, employees, and the public.

THE PUBLIC'S RIGHT TO ARBITRATION OF LABOR DISPUTES.

On account of the inconvenience, and, in some cases, hardship, that would result to the public from an interruption of railway service, I believe that, if any such interruption shall occur as a result of a difference between employers and employees, the public has a right to such full information as may serve as a basis for an intelligent opinion as to the merits of the controversy. This is most effectually accomplished by the Canadian Industrial Pursuits Investigation Law which provides that where a strike or lockout is threatened involving any agency of transportation or communication, or other public service utility, before such strike or lockout can legally take place the parties must refer their differences to a special board which exercises substantially the powers of a court in hearing a case. The first efforts of the board are to bring about a settlement by conciliation. Failing in this, it prepares and publishes a report setting forth what, in the board's opinion, ought or ought not to be done by the respective parties concerned. The essential difference between this Canadian law and the Erdman law is that resort to the Erdman law is altogether voluntary, but, under the Canadian law, while resort to it is compulsory, the finding of the board is not binding on either party. For effectiveness the Canadian law relies largely upon the force of enlightened public opinion. If, after publication of the finding of a board, a strike or lockout occurs, the public knows what it is all about and what the board has recommended should be done in the matter. It amounts in substance to the very reasonable provision that before the service of a public utility agency on which the public is dependent shall be interrupted by a strike or lockout the public shall be fully enlightened as to the merits of the controversy.

Each special board under the Canadian law consists of three members. One is named by each party to the controversy and they select the third, who acts as chairman, or, if they shall fail, within five days, to agree upon the third member, he is appointed by the minister of labor. The fault of a board thus constituted, in my opinion, is that, two of its members being partisans, its decisions are essentially one-man decisions and the questions presented are not considered as broadly as might be expected with a larger board. I venture to suggest, therefore, that the provisions of the Canadian law shall be adopted, except that, instead of three members, each special board shall consist of five members; that one be named by each party to the controversy; that these two jointly select two others, or, in the event of their failure to agree, that the two others be named by the commissioner of labor and the presiding judge of the commerce court, or, if there be no commerce court, the chairman of the Interstate Commerce Commission, and that the two last named shall select the fifth member, or, in the event of their failure to agree upon the fifth member, that he be appointed by the senior United States Circuit Judge in the territory affected. I believe the result would be broader consideration of the questions at issue and findings that would command, in fuller measure, the support of public opinion and the confidence of the parties in interest.

GOOD SERVICE THE PARAMOUNT NEED.

While the discussion of the relations between the public and the railways has been concentrated largely upon charges for transportation, the public has a vital interest in service as well as charges. In fact, if charges are not exorbitant or unreasonably high as measured by the service performed, the paramount interest of the public is in service.

It is the aim of the far-sighted railway manager to maintain a margin of carrying capacity over the normal demand on his lines in order that he may be able to handle any sudden increase in the volume of traffic. The difficulties that must be encountered in doing this can hardly be appreciated by those not engaged in railway work. James J. Hill, the highest authority on such matters in the United States, emphasizes the need of additional trackage and enlarged terminals, but large expenditures are required for their provision. Future growth of business is always problematical, and it requires a high degree of courage, in dull times when an existing railway plant is working far below its capacity, to enter upon projects for building additional main tracks or for enlarging terminals. It requires courage to contract for additional equipment when side-tracks are full of idle cars and roundhouses are crowded with cold locomotives. The railway manager may believe there is every reason to expect a large increase in business, but if his judgment shall be at fault he will have trackage in excess of his needs and will see his new cars and locomotives standing idle and depreciating without having had a chance to earn a dollar, while all of the time interest charges are accruing on the additional investment. Yet, so far as his resources will permit, this is the policy that the railway manager must carry out. He cannot wait until the crisis is upon him for the inauguration of constructive policies.

The same is true as to maintenance, and it is to the public interest that the railways shall not have to postpone repairs and catch up with maintenance work in times of heavy traffic. This is a matter that cannot be unduly neglected at any time, for there is probably no class of property subject to such rapid depreciation as a railway. Conditions of railway operation are such as to subject roadway and equipment to great wear, and as very little railway property is under shelter, it is subjected to constant depreciation from exposure even if it is standing idle, and a considerable proportion of expenditures for the

maintenance of both roadway and equipment must be made irrespective of the volume of traffic being moved.

There is probably no other form of industry that suffers so much in times of business depression as does a railway. When the business of a manufacturing plant falls off it can run on short time or stop running altogether. No matter, however, to what extent the business of a railway may fall off, there is a minimum of service that it must continue to perform and all of the time its plant is subject to just as much depreciation from exposure as though it were working at full capacity. I may say further that there is probably no other industry in which, from the nature of the business, such a large proportion of the plant must at all times be idle. This may be illustrated by the fact that it has been estimated that the average movement of freight cars in the United States is only twenty-five miles per day, yet while the car is actually under way its movement is at a very much higher rate than this. The reason for the low average rate is that it is figured on all of the freight car equipment of the railways of the United States and includes not only the cars that are in transit but surplus cars that are standing idle on side tracks at times when the demand of the country is not sufficient to employ them, the cars that are being held by shippers for loading and unloading and the cars that are in shops for repairs. Under the latter head alone, owing to the high rate of depreciation from use and exposure, an average of approximately 6 per cent. of the freight cars of the United States and about 10 per cent. of the locomotives will be found in the shops at any given time.

One of the strongest arguments against the policy of attempting so to regulate railway charges that they shall yield a predetermined rate of income rather than allowing them to be so adjusted as to be reasonable as measured by the service performed is that it may, by its arbitrary enforcement, tend greatly to hamper the railways in the provision of additional and improved facilities and in the proper maintenance of their present plant. One of the distinguishing features of American railway management as contrasted with that of other countries is that, so far as earnings would permit, the owners of American railway properties have, in many cases, abstained from taking to themselves the full amount of net income, but have turned greater or less proportions of it back into the property in the provision of improvements that have not been capitalized, in contrast with the prevailing custom in other countries of capitalizing all improvements. It is largely because of this that the average net capitalization of the railways of the United States is only approximately $60,000 per mile as compared with $314,000 per mile in England, $109,788 per mile in Germany, and $139,237 per mile in France. It is to the public interest that this policy be continued.

As railway operation must be continued in times of business depression, and as floods or other disasters may at times do enormous damage to railway property, the railways should be able, in times of prosperity, to accumulate a sufficient surplus to enable them to meet their requirements in lean years.

Even under the most favorable circumstances, however, the railways cannot return earnings to the property in amounts sufficient to enable them to meet the increasing demands for service. To a large extent additional carrying capacity will have to be provided through the investment of new capital. Ability to obtain new capital is dependent upon credit, and credit, in turn, is dependent, not on gross earnings, but on the proportion of gross earnings that can be saved as net income. It should be borne in mind that the natural tendency of capital is toward those investments promising the largest income in proportion to the safety of the principal.

PROSPERITY OF RAILWAYS DEPENDS ON THE PUBLIC.

Under the present system of governmental regulation in the United States the prosperity of the railways and their ability adequately to perform the transportation service of the country is dependent in very large measure upon the state of the public mind toward them. It is to the public interest no less than to that of the railways that, while laws for the prevention of abuses shall be enforced and, if necessary, amplified and strengthened, the attitude of the government should be such as to instill into the public mind confidence in the railways, for, under the present system of governmental regulation of the fundamental business of transportation there is attached to the government, as well as to railway management, responsibility for the success of a business so closely related to all the business activities of the country.

This thought was admirably expressed by that sound economist—President Hadley—when, in a recent address, he said: "We must lend a hand to the men who are getting things done. We shall deal with the problems of corporate regulation and with the abuses of corporate management more effectively if we are willing to appreciate efficient service."

If the railways are to have the character of support of which President Hadley has spoken, they must justify it. The obligation rests upon them to give the most efficient transportation service in their power without unjust discrimination, and at rates that are not unreasonable as measured by the service performed. Seeking exemption from unjust political attack, they should themselves abstain from political activities. There was a time when their support of policies deemed essential to the preservation of our civilization was urged upon them as a patriotic duty. I think we may all rejoice in the awakening of public conscience and the elevation of public standards which would condemn any return to those conditions.

But, in advocating abstention by the railways from such activities, I should not be understood as implying that they should surrender any of the fundamental political rights to which they are entitled in as full measure as any other business enterprise or individual citizen. These rights include the sacred right of petition—the right to be heard in argument and in protest before legislative bodies, the courts of the land, administrative tribunals, and before the bar of public opinion.

A PILOT SNOW PLOW.

By E. R. LEWIS,
Assistant to General Manager, Duluth, South Shore & Atlantic, Duluth, Minn.

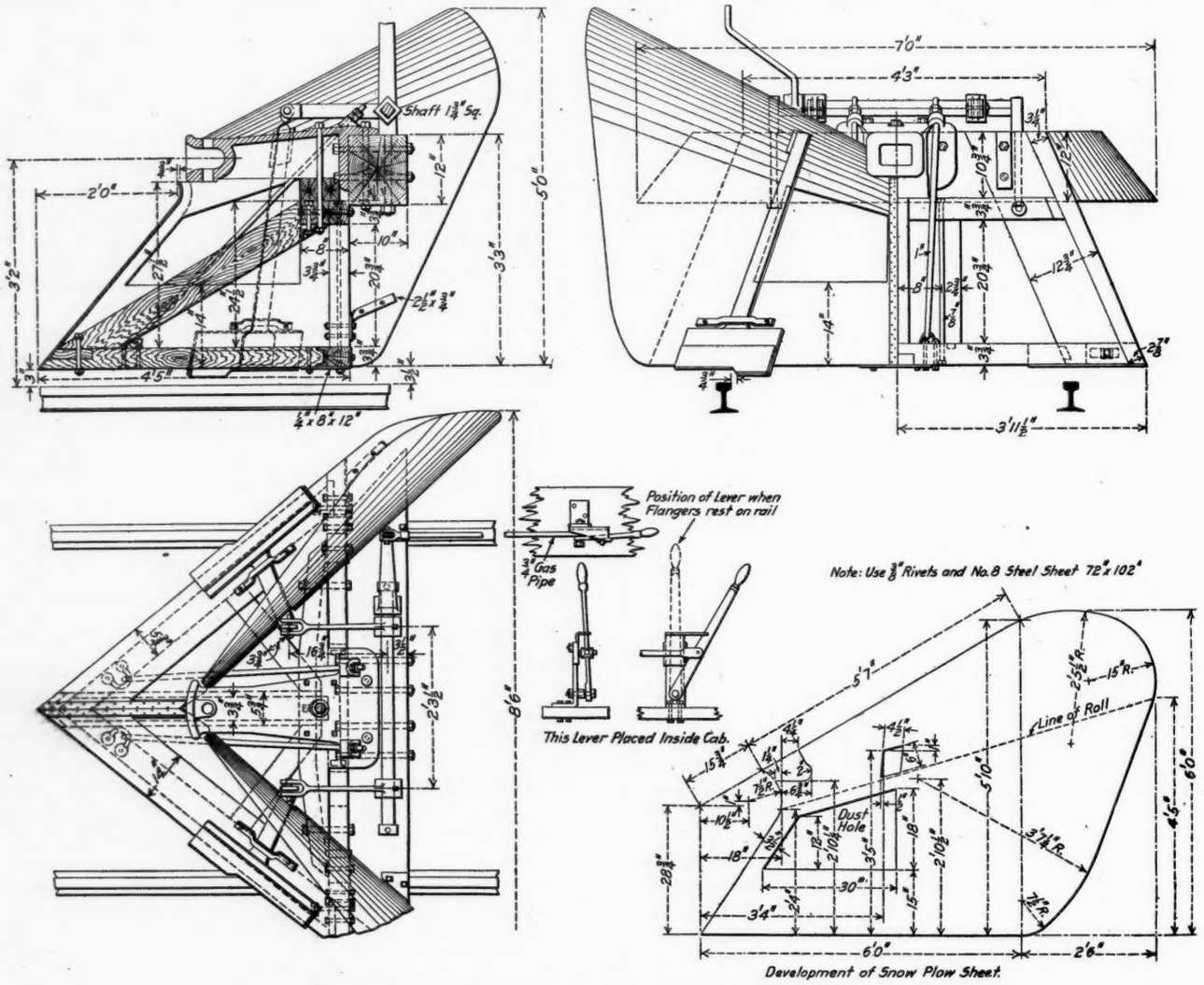
No locomotive, however powerful on a dry rail, can make satisfactory progress during severe blizzards in freezing weather, unless it is well supplied with snow handling attachments. It is by no means sufficient to provide engines, pushing snow plows and flangers, to run ahead of trains drawn by locomotives which have no such equipment. During exceptional winter storms, snow will drift in behind a snow plow and obstruct the track in a very few minutes after the plow has passed.

Every locomotive which is expected to make a trip in such weather should carry its own protection against drifting snow. The ideal equipment is the combined pilot plow and flanger, one style of which is shown in the accompanying illustration. These plows should be attached to the locomotives at the beginning of the season of severe winter storms, and removed only after danger of such weather is past. They will handle snow in drifts 6 to 10 ft. deep. The flangers are of course of service in cleaning snow from the rails and away from the flanges. By cutting loose from the train and flanging the track for a car length or two, the rail can be cleared of snow and ice so that the driving wheels will not slip or skid and the engine will gain sufficient headway to push through the drift. Care must of course be taken not to get so far from the train while flanging that the locomotive cannot recouple to the train, which would then freeze up.

The plow here described is believed to be built on the lines of maximum efficiency. The nose is set at an angle of 40 deg. from the vertical. The spread of the wings includes a total horizontal angle of 72 deg. 30 min. The rise and flare of the wings from nose to heel are such as to give the best results

in lifting and clearing snow from the tracks. A distinct advantage over most pilot plows is the position in which it is placed, close to the front of the locomotive. The pilot and pilot beam may be removed, and the snow plow with its beam put in place by 4 men in about 4 hours.

Locomotive pilot plows should be provided with dust doors, which when opened, allow dust from the ballast, which gathers under a plow on bare, dry track, to escape. The No. 8 steel sheets which form the plow armor are provided with square sliding doors of the same material, on each side of the nose, so fashioned as to cover or uncover a square space in the sheet a trifle smaller than the door, which works in grooves on the outside of the plow, and which may be fastened open or shut. The flangers are operated by a lever in the locomotive cab. The bottom leaves or shoes are of spring steel. If a flanger is broken, a spare shoe may be readily applied by means of four bolts without going into the repair shop. The pilot plow and flanger combined costs $150. The plow and flanger here described were designed and constructed under the supervision of J. J. Conolly, superintendent of motive power and machinery, Duluth, South Shore & Atlantic, on which road it has been in use for more than 20 years with the most satisfactory results.



Combined Pilot Snow Plow and Flanger; Duluth, South Shore & Atlantic.

Fuel in Roumania.—In Roumania a few locomotives were converted into oil-burners as long ago as 1887. In 1911, out of a total of 595 locomotives, 499 used oil for fuel. About five-eighths of fuel used is petroleum, one-eighth is coal from Cardiff and Westphalia; more than a seventh, lignite; and one-tenth, wood.

ACCIDENT STATISTICS FOR 1910.

The annual statistical report of the Interstate Commerce Commission for the year 1910 contains no information concerning casualties on railroads, the carriers having been relieved from furnishing this in their annual reports, and the law providing this exemption, and transferring the accident records to another department, having failed to provide for beginning the new records immediately on the cessation of the old. Therefore, one whole year was left out of the annual records. This omission is not important except as concerns accidents to persons at highway crossings, to employees not on duty, and to trespassers, as other accidents had already been provided for in the records published in the quarterly bulletins.

The commission, however, issued a circular calling for a special report on the year 1910, and now publishes a statement showing the totals for that year, made up on the basis of the classification which had been used in the annual statistical report. The total number of persons killed on the railroads of the country in the year under review, ending June 30, 1910, was 9,682, and of injured 119,507. The number of passengers killed was 324; employees 3,382, and other persons 5,976; passengers injured, 12,451. employees 95,671, and other persons 11,385. At highway crossings 835 persons were killed and 1,932 injured. The total number of trespassers killed, all causes, was 4,864; and injured 5,348. These trespassers are included in the "other persons" mentioned above. The regular accident-bulletin statistics for the year ending June 30, 1910, were given in the *Railway Age Gazette* of November 11, 1910, page 925.

General News.

In the federal court at Boston, February 4, the Central Vermont and the New York, New Haven & Hartford were fined each $300 for violations of the safety appliance laws.

Alfred Knight Chittenden, forester of the United States Indian service, Department of the Interior, has been appointed assistant to the director of the engineering experiment station of the University of Illinois, and lecturer on timber and timber resources in the college of engineering.

Suit has been begun by the government in the federal court at Philadelphia against the Philadelphia & Reading for violation of the 28-hour law regulating the transportation of cattle. It is alleged that two carloads of cattle from Buffalo were kept in cars from 38 to 46 hours without food or water.

The Great Northern on January 29 opened its road over the Cascade mountains after a blockade which had lasted six days. The fall of snow has been the heaviest in many years. Many tons of dynamite were used in clearing away masses of fallen timber, rocks and earth which had been swept on to the roadway by avalanches.

The Chicago, Milwaukee & St. Paul has recently received from the builders seven gasoline-electric motor cars built by the General Electric Company, which are to be placed in service shortly for branch line service. Two of the cars will be used on the Puget Sound lines. Five of these cars each weigh 49 tons and are designed for a seating capacity of 80; two weigh 50 tons and have seats for 77 passengers.

A special train on the Pennsylvania lines used to carry cash each evening from the Stock Yards to the Union station in Chicago, was robbed early in the evening of January 31 by one man, who boarded the train as it was passing through the yards before entering the station, and forced the express messenger to open the safe for him. After taking the money and checks from the safe he jumped from the train and escaped pursuers.

Presidents Mellen, of the New Haven, and Chamberlin, of the Grand Trunk, together with A. W. Smithers, chairman of the Grand Trunk, were again indicted in New York City, January 30, for alleged violation of the anti-trust law in connection with the cessation of work on the Grand Trunk line to Providence last autumn. The indictments are substantially the same as those which were found a few weeks ago and which were invalidated on a technicality.

A contract has been signed by the Minneapolis, St. Paul & Sault Ste. Marie and the Baltimore & Ohio, whereby the Soo line will use the tracks of the Baltimore & Ohio Chicago Terminal into the Grand Central station as the entrance into the city of Chicago for its passenger trains. The change will not go into effect until about July, 1914. The Soo line is now using the tracks of the Illinois Central. The Grand Central station was formerly owned and used by the Wisconsin Central, which is now the Chicago division of the Minneapolis, St. Paul & Sault Ste. Marie.

The Pennsylvania Railroad reports the smallest loss from fire experienced by the company in thirty-four years. In 1908 the company's employees extinguished 274 fires out of a total of 1,397 which occurred on railroad property, and in 1912 454 out of a total of 905. The steady increase in the efficiency of the fire fighting brigade was further developed last year by special training of employees and equipping additional locomotives in yard service with pumps. Including the fires to which city fire departments were called, the total loss was only $219,892 from the 905 fires.

The frauds connected with forged bills of lading for cotton which made such a sensation in the southern states a couple of years ago, have again come into notice by the commencement of a suit in the United States Court at New York City by A. Hannay & Co., of Liverpool, against a New York bank, for losses on drafts drawn in connection with worthless bills of lading. The drafts had been discounted for Knight, Yancy & Company and Steele Miller & Company shortly before the failure of those firms. If this suit against the New York bank should succeed, it would open the way to the prosecution of similar suits for sums aggregating $4,500,000.

G. A. Ogline, superintendent of police of the Baltimore & Ohio, in his annual report, which has just been made, and in which he reports a total of 10,417 arrests made during the year, says that from his observation during travels over American railroads during the past year he believes that the trespassing evil is growing rapidly. During the year 289 persons were killed and 298 injured while trespassing on Baltimore & Ohio property. Mr. Ogline suggests that a good cure for vagrancy would be the maintenance of a stone pile. There is nothing which the tramp so dislikes as the labor of splitting stones.

The *Railroad Telegrapher*, the organ of the Order of Railroad Telegraphers, in its January issue reports that in the month of December the number of new members initiated into the order was one thousand nine hundred and twelve, the largest on record for a single month; and in the twelve months of the year one thousand nine hundred and twelve the total number of new members was 10,339. The total present number of members is not given. A list is given of the names of 58 railroads on which new and revised schedules of wages for telegraphers were made during the year 1912. The Grand Lodge gives prizes to members who secure new members; one bringing in twenty-five or more being offered a gold watch.

The Bangor & Aroostook has nearly or quite won its contest with the striking enginemen and firemen. It now has enough firemen for all trains and is short only twenty of its full complement of enginemen, though it is said that some of the enginemen have not yet fully learned the road. The leaders of the conductors' and trainmen's unions demanded last week a large increase in pay, but as yet they have not struck, and it is believed that probably the rank and file did not vote to sustain the leaders. It is said now that the track repair men, or some of them, are threatening to strike. The governor of the state of Maine sent to the legislature a message recommending arbitration or other measures to settle the strike, but both houses of the legislature laid the message on the table.

The Western Union and Postal Telegraph companies have filed with the New York Public Service Commission, Second district, new rates for money transfer service, effective March 1, 1913, as follows: Transfer premiums for $25 or less, 25 cents; over $25 and not exceeding $50, 35 cents; over $50 and not exceeding $75, 60 cents; over $75 and not exceeding $100, 85 cents; for each additional $100 or fraction thereof up to and including $3,000, 25 cents; for each additional $100 or fraction thereof over $3,000, 20 cents. In addition to the premium there will be a charge for telegraph service equal to the price of one fifteen word message from the office of deposit to the office of payment. The new rates greatly reduce the present charges which are as follows: Premium 25 cents for $25 or less, and 1 per cent. on all sums of more than $25 and not exceeding $1,000. For amounts over $1,000 1 per cent. for $1,000, and one-half of 1 per cent. for any excess over $1,000, fractional part of a dollar counted as a dollar, and in addition charge for telegraph service equal to twice the toll on a ten word message from the depositing office to the paying office.

The Purchasing Power of Money.

A leading financial paper says that the Atlantic Coast Line will use $40,500 from the proceeds of the sale of stock for the following purposes: Additional equipment, new construction, bridges, trestles, yards, terminals, shops, double track, creosote and rock crushing plants, block signals, telephone circuits and other additions and betterments.

Guilty on All Counts, But Unashamed.

The connection between the retail tobacco business and steel manufacturing and railroading may not be visible to the naked eye, but it is there, just the same. That is to say, it was there. Because the connection no longer exists a certain cigar dealer mourns the loss of $3,000 worth of business. In these uncertain times one can feel real badly over the loss of $3,000. But to explain: You see in the good old days sundry manufacturers of steel products were in the habit of making through their salesmen little Christmas gifts to the purchasing agents of railroads with which they did business, or hoped to do business. The cigars never did any one harm, because they were good

cigars. They merely helped to promote the entente cordiale between the salesman and the purchasing agent. The *Railway Age Gazette* heard about it and straightway became exercised over what it declared was a pernicious practice. The *Gazette* raised such a hullabaloo that presently the railroad men up at the top and the steel men in the same relative position concluded that perhaps the entente cordiale did not need any promoting, after all. So when Christmas came this time three or four steel representatives who had been making Christmas purchases aggregating $3,000 of the cigar dealer aforesaid did not buy so much as a package of cigarettes. It would have been bad enough if they had transferred their patronage elsewhere; but they did much worse; they simply kept their money in their pockets. No doubt the railroad men who have been having one on the steel salesmen will continue to smoke; but when one purchases one's own cigars one is likely to smoke less expensive cigars and fewer of them. Besides, their custom will be scattered, so that no one will reap any appreciable benefit. Shame on the *Railway Age Gazette.—United States Tobacco Journal.*

Railway Bills in the Legislatures.

Both houses of the Michigan legislature have passed a resolution providing for an investigation by a state commission of the financial and physical affairs of the Pere Marquette.

A bill has been introduced into the Minnesota legislature proposing an increase in the railroad gross earnings tax rate from five to six per cent. The last legislature increased the rate from four per cent to five.

A bill has been introduced in the Colorado senate, which would make trespassing on railroad tracks a misdemeanor punishable by fine, or imprisonment, or both. During the fiscal year 1912, out of 95 people killed on the railways of Colorado, 52 were trespassers.

Bills have been introduced into the Michigan legislature providing for a semi-monthly pay-day, requiring that all cabooses be built according to a standard plan, and providing for a ten-cent additional charge where fares are paid in cash on passenger trains. A full crew bill also has been presented.

A bill has been introduced in the legislature of New York at Albany, to empower the public service commissions to suspend railroad tariffs which propose increases of rates, in the same manner that such tariffs are suspended by the Interstate Commerce Commission. A similar bill was passed last year, but was vetoed by Governor Dix.

A full-crew bill has been introduced in the legislature of Colorado. Committees representing the brotherhoods of trainmen are endeavoring to have the bill made even more sweeping than are the laws on this subject now in force in other states; while arguments have been presented on behalf of the railway companies showing the unreasonable character of the bill.

A bill has been introduced into the Kansas senate requiring railways to pay their employees twice a month. At a hearing before the railroad committee recently, E. L. Copeland, secretary and treasurer of the Atchison, Topeka & Santa Fe, offered documentary evidence showing that if the bill were passed it would increase the expenses of the Santa Fe by about $24,000 a year.

A bill has been introduced in the Illinois legislature providing for the creation of two public utilities commissions, one for Chicago, and one for the state at large, to replace the present railroad and warehouse commission. The Chicago commission is to be appointed by the mayor, and the state commission by the governor. Each is to consist of five members at a salary of $10,000 each, yearly, with a secretary for each commission at a salary of $6,000.

Representative Hughes, of West Virginia, has introduced in Congress a bill providing that after January 1, 1915, all passenger, express and baggage cars used in interstate traffic shall be made of steel, with vestibuled platforms; the Interstate Commerce Commission to have authority, however, to extend the period of time within which any carrier shall comply with the law.

Representative Dent of Alabama has introduced in Congress, a bill making it unlawful five years after date for any common carrier to use any locomotive or car for passenger traffic not equipped with some safety device for the prevention of derailments resulting from broken flanges, broken wheels, etc. Mr. Dent evidently has in mind the virtues of somebody's patent for causing cars which have jumped the track to immediately jump back on the rails again.

Illustrated Lectures for Central of Georgia Employees.

The farmers are not the only beneficiaries of the traveling lecturer. The Central of Georgia has just started a lecture car for the benefit of its employees, and moving pictures constitute one of its main features. It is managed by the Educational Bureau of the road, in charge of D. C. Boy, assistant chief. The lecturers are E. H. Daniel, transportation inspector, and A. D. Prendergast, road foreman of engines. The lectures were begun at Albany, January 28, and they are in substance as follows:

First: "Fuel Economy, or Proper and Improper Locomotive Firing," by Mr. Prendergast. This lecture is illustrated with fuel tests, colored slides showing condition of fuel in fire box, and by moving pictures showing proper and improper methods of handling scoop-shovel, firing a pusher engine up hill, result of good and bad firing as seen from rear of train by the passenger, coaling engines, etc. A double-header is shown going up hill, the front engine being fired properly and the second engine fired improperly, as evidenced by the light smoke coming from the stack of the first engine, and the dense black smoke from the second engine. These moving pictures were taken on the Central of Georgia in and around Macon.

The second lecture, by Mr. Daniel, is on train rules. "Always Safety First" is the first and the last stereopticon slide shown. Following this many of the train rules are shown and explained. Pictures are shown illustrating the violation of rules and bad practice of trainmen, such as adjusting couplers, jumping on moving cars, etc.

The third lecture takes up loss and damage freight. There are several slides calling attention to the cost to the company of loss of and damage to freight. Following these are pictures showing loading and handling of freight at stations and in trains.

Opening of the New Grand Central Terminal, New York.

The new headhouse of the Grand Central Terminal, Forty-second street, New York City, was opened for business at midnight on Saturday, February 1, and all day on Sunday the station was crowded with sightseers. The concourse for the lower level was opened several weeks ago, and the principal rooms now opened are the main waiting-room, the men's and women's waiting-rooms adjacent, the upper concourse, and the restaurant. The concourse, ramps and tracks which will eventually serve for incoming trains and passengers are yet to be built, and the exterior of the station is not entirely finished; but in its main functions, the new station is now in service and the old "Grand Central Palace," in which was the temporary main waiting-room during the construction of the new bulding, has been vacated and the wreckers have already begun to tear it down. The hospital at the corner of Forty-second street and Lexington avenue, on which site the New York Central proposes to erect a hotel, is also being torn down.

Warren & Wetmore, the architects of the new station, gave a dinner in the restaurant of the station on Saturday evening to A. R. Whaley, and about 100 guests. Mr. Whaley, who has just resigned, has been general manager of the Terminal for several years past. About two thousand guests of the architects inspected the station Saturday afternoon and evening. Preparatory to opening, at midnight, the company had decorated the principal rooms with palms, and there was a band of music on hand; and when the doors were opened at 12 o'clock about three thousand persons, who had been waiting outside, rushed in.

The progress of the work on this station has been recorded from time to time in the *Railway Age Gazette,* the last article having been published on November 22 last, page 981. Photographs of the interior of the new station have not yet been taken.

Among the accounts of the opening published by the New York City papers, that of the *Evening Post,* which embraced a

large number of illustrations made from architects' drawings, is of interest historically by reason of several views which it shows, illustrating the New York terminals of the Harlem, the New Haven and the Hudson River railroads in early years. The *Evening Post* also prints a short article written by John N. Golding, the real estate agent who, in behalf of the New York Central, bought lands and buildings for the new terminal. From this we quote:

"Securing such a site as is embraced in the Grand Central Terminal necessitated buying two large hospitals, two large warehouses, orphan asylums, churches, rows of flats, house after house, vacant land, stables, express buildings, etc. In no instance was a property purchased from other than the original owner of record. This part it was my privilege to be engaged in accomplishing. No profits to speculators.

"The city of New York has every reason to be proud of the Grand Central Terminal and all that pertains to it. Each man from the president down had to do his share and do it well to make the undertaking go, and they did not fail.

"The gathering of the big financial men of the country, composing this board, was the primary authority. Trusting the operation to selected individuals in their line, the board controlled the adjustment of all legal difficulties, the rearranging of grades, new streets, exchanging of one part of a street for another part; conference after conference, public hearings, some pleasant and others a little unpleasant, everybody keeping his temper, all with a fixed purpose, and the undertaking was completed. Ideas advanced, turned over, looked into, followed, the brains of the whole system worked together.

"Property owners demanded that the streets be made from Lexington to Madison avenue; month after month conferences were held with representatives of the city, necessitating a great deal of thought on the part of the head of the legal department, Ira A. Place, and his associates; and the whole proposition was directed by the masterful mind of the railroad's late president, William H. Newman, who has made it a lifework, bringing about this wonderful result.

"With the 26-story Biltmore Hotel, the Yale Club, the Grand Central Palace, the Y. M. C. A.'s new building and stores and apartment houses, new hotels and other buildings now talked of, the tract from Forty-second to Fiftieth street, embraced in this terminal, will be the greatest business, club, amusement and apartment house center in the city. There are many wonders in this great city, and this terminal is one of them. But to my mind there is a greater wonder, and that is, *how they had the hardihood to do it.*"

Harriman Lines' Dissolution Plan.

Though the Harriman Lines' committees and the government have not yet reached a definite decision in regard to the plan for the dissolution of the Union Pacific-Southern Pacific system, it is believed that the plan is crystallizing rapidly and will probably be announced this week. It is expected that this plan will call for the sale of the Central Pacific to the Union Pacific for cash. It was the desire of both the railroads and the government that the Central Pacific should be paid for partly with Southern Pacific stock, but this is impossible because of a Kentucky statute prohibiting the Southern Pacific from purchasing its own stock. It is estimated that the price to be paid for the Central Pacific will be in the neighborhood of $100,000,000. The $126,000,000 Southern Pacific stock owned by the Union Pacific will probably be offered at about par to Union Pacific and Southern Pacific stockholders. The exact proportion to be offered to stockholders of the Union Pacific is not yet known. The offering of this Southern Pacific stock will be underwritten by a syndicate. This plan is merely the agreement expected to be reached between the directors of the two roads and the attorney general. The plan will then go to the circuit court of the Eighth district for final approval.

R. S. Lovett, chairman of the executive committee of the Union Pacific is quoted as saying, in part:

"The operating organizations of the Union Pacific and Southern Pacific in the West were separated a year ago last October, from the president down. The only joint offices and officials left after that reorganization and at the time of the decision of the Supreme Court in December were the directors, chairman of the executive committee, directors of maintenance and traffic and other officers in New York and the commercial and soliciting agents.

"When the attorney general's position respecting the disposition of the Central Pacific was made known, thereby showing a possible conflict of interest with respect to that property, the chairman and directors of the Union Pacific informed him that of course they could not further act for the Southern Pacific and immediately resigned from the Southern Pacific so that the latter board could be composed of directors not interested in the Union Pacific. This occurred on January 13."

Firemen's Wages.

Elisha Lee, chairman of the committee representing the eastern railroads, which committee expects to hold next Tuesday another conference with the representatives of the firemen, has issued during the past week a number of statements to the public. Commenting on the published statement of the leader of the firemen, relative to the delay in settling the case of the locomotive enginemen, he calls attention to the fact that the delay caused the enginemen no loss; for though the increase in pay which was voted was not announced until November 26, it was made to take effect on May 1. The men received back pay amounting to about $1,000,000. Mr. Lee says that the total annual increase in the pay rolls of the enginemen will be about $2,000,000, or approximately 5 per cent. In other statements he says:

"This strike vote of the firemen was taken in the face of the railroads' offer to submit all matters in controversy to an unbiased arbitration commission of five, seven or nine men. The firemen will endeavor to gain the support of public opinion. General chairmen are directed to make arrangements whereby publicity can be given to all matters in connection with this movement 'whenever it becomes evident that no settlement can be reached.'

"The railroad managers have learned with considerable surprise that the firemen are also polling the engineers who belong to the brotherhood. These same engineers have had their wages increased by the arbitration award recently announced and intended to continue until June 1.

"The attitude of the firemen's brotherhood towards the form of arbitration followed in the engineers' case may be gained from a letter addressed by President Carter to the railroads, in which he says:

" 'It is noted that in your objections to the federal arbitration law that you believe its most fundamental defect is that the interests of the public are not guarded by it. Our committee instructs me to compliment the conference committee of managers upon their solicitude for the interests of the public. . . . We hold that an arbitration of a wage dispute should not be used for the purpose of molding public opinion as to the necessity of enacting laws to forbid railway employees engaging in strikes, or to secure legislation that will deprive workingmen of their constitutional rights, which seems to have been the purpose of the railroads' plan of arbitration. In any arbitration of wage matters social or legislative problems should not thus be injected. It is evident that the wish of certain prominent railroad officials has found expression in the report of this arbitration, under the railroads' plan, that national and state wage commissions be established, with power to enforce decrees. Advantage should not be taken of wage disputes to mold public sentiment concerning the proper returns upon capital invested by railroads or the necessity for increase in freight rates.' . . .

"The railroads still offer arbitration by a board representing the public. The railroads base their case upon the recent conclusions of the board appointed to adjudicate the claims of the engineers. That board, after examining the record of the operation of the Erdman act, stated that its results were 'accomplished by splitting differences, and the case may be adjusted without adequate investigation of the facts involved, in consequence of which the award may not rest upon a basis of equity. This method of splitting differences is very unsatisfactory, but it is an inevitable result of mediation or arbitration under the Erdman act. Feeling in advance that a mediation or arbitration will result in giving only a part of what they ask, the men make maximum demands, with the expectation that these demands will not be fully awarded. The railroad officers, appreciating

the tendency of mediators and arbitrators to split differences, make only minimum concessions or none at all.'

"The railroads have offered to grant concessions to the firemen. They have offered them what is tantamount to an increase of 5 per cent. in their total payroll. . . . The railroad managers are only too glad to pay their men high and increasing wages. It is only from a feeling that such increases as have been demanded are not justified by the conditions, that railroad managers are moved to resistance.

"The companies would regard a strike with dismay. Such an outcome of this situation must be prevented, in the public interest. If the public can insist that there be no strike and that there be arbitration properly guarding the interests of the public, the railroads and the employees, a most important result will have been achieved.

"The railroads have offered their men a minimum wage of $2.40 a day in passenger service. The present minimum is $1.75, though this minimum is paid on but few roads. In through freight service the railroads have offered a minimum of $2.75 per day. They have also offered increases of 10 and 15 cents per day on certain freight engines. All firemen working on freight engines now receive at least $2.45 a day. The Boston & Albany now pays $3 per day; the Baltimore & Ohio $2.75, $3 and $3.10; the Delaware, Lackawanna & Western, $2.90; the New York, New Haven & Hartford pays $2.60 and $2.80 per day; and the Pennsylvania Railroad and the New York Central pay $2.85 and $3. These are through freight rates.

"According to the recent arbitration commission in the engineers' case, the average wages of firemen in the district affected by the present strike vote are $2.88 per day. Ten years ago the average was about $2.05, so that the average wages of the firemen who are now threatening to strike have been increased more than 35 per cent. in the past ten years. Railroad managers are willing and eager to pay all classes of employees as high wages as conditions will permit. It is indeed recognized that the firemen at this moment deserve special consideration. But, it is obvious that the public must pay the bill in the end, and the question the public has to answer is: How long shall this process of increases be allowed to continue?

"Chief among the propositions which the men have voted on, and which the railroads already have offered to arbitrate, is a demand that there shall be two full-paid firemen on about 2,000 out of the 14,000 freight locomotives in the territory affected; that is, on all engines of more than 200,000 lbs. weight on the drivers. The railroads concede that there are cases deserving relief. On the Pennsylvania, for instance, where under the Pennsylvania state extra-crew law an additional brakeman is employed, he is required to assist the fireman in shoveling coal on a hard run. On other roads in some cases two firemen are employed for a full run. The railroads propose to the men to refer each case back to the local officers and men to settle; where it cannot be settled satisfactorily, to appoint a permanent committee of appeal for all the 54 railroads which shall have power to inquire into the case and settle it fairly.

"An arbitrary rule would unduly burden the railroads and would cause the companies to employ a large number of unnecessary firemen. But even this proposition the companies are prepared to leave to the judgment of a committee of citizens sufficiently large and representative, to consider and settle fairly the subject on behalf of the public, the railroads and the employees."

"The firemen have notified the managers that if the railroads do not grant two firemen on locomotives they will get the equivalent through federal legislation. At a conference on December 20, President Carter said 'if they could not get relief across the table they would have to get it at Washington. We are trying to get it across the table. If we don't get it here, you can depend upon it they will get it at Washington. I mean they will get the ten or twelve-hour day, and they will not get it through this organization, but they will get it through the individual members of Congress.' The railroads concede that the strain upon firemen has increased. All the railroads have given serious and sympathetic attention to this subject. Many factors besides weight enter into this question. An engine may be heavy, but the run very short. Many railroads are trying automatic stokers, so that all the fireman has to do is to stand by and see to it that the stoker works properly. But even on such engines the brotherhood demands two firemen."

Western Economic Society.

The Western Economic Society will present at its conference a thorough discussion of the modern ideals of organization, efficiency and scientific management. A number of prominent advocates of scientific management will present the fundamental features of their plans and an opportunity will then be given for discussions, questions and criticisms. The conference will be held on March 14 and 15, at Chicago.

Papers will be presented on such topics as the following: The Spirit of Scientific Management; Scientific Management from the Manufacturers' Point of View; Scientific Management versus System; Scientific Time Study and a Proper Task; Wage Systems and their Consequences; Planning Room and Functional Foremanship; the Importance of Standardization; Organization and Personnel; the Selection of Employees; Scientific Management in Commercial Enterprises; the Social Significance of Scientific Management; Scientific Management and the Laborer; Some Object Lessons in Scientific Management; and the Taylor Sysetm.

The following have accepted invitations to present papers on these subjects: Carl G. Barth, consulting engineer; Dr. K. M. Blackford; the M. Rumeley Co., La Porte, Ind.; M. L. Cooke, consulting engineer; Harrington Emerson, consulting engineer and author of the "Twelve Principles of Efficiency"; E. M. Feiker, the System Company; Hollis Godfrey, consulting engineer; H. K. Hathaway, vice-president of the Tabor Manufacturing Co., Philadelphia, Pa.; H. B. Kendall, the Plimpton Press, Norwood, Mass.; F. W. Taylor, founder of the Taylor system of scientific management; C. B. Thompson, in charge of work on industrial organization of Harvard Graduate School of Business Administration; S. E. Thompson, consulting engineer; Amasa Walker, Longmans, Green & Company; and William B. Wilson, chairman of the committee on labor of the United States House of Representatives. A number of papers will probably be presented by others. All sessions are open for general discussion. The officers of the company are as follows: President, Shailer Mathews; vice-presidents, Franklin MacVeagh and George E. Vincent; treasurer, Charles L. Hutchinson; and secretary, Leon C. Marshall, dean of the College of Commerce and Administration of the University of Chicago.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State St., Boston, Mass. Convention, May 6-9, St. Louis, Mo.

American Association of Demurrage Officers.—A. G. Thomason, Boston, Mass.

American Association of General Passenger and Ticket Agents.—W. C. Hope, New York.

American Association of Freight Agents.—R. O. Wells, East St. Louis, Ill. Annual meeting, June 17-20, Buffalo, N. Y.

American Association of Railroad Superintendents.—E. H. Harman, St. Louis, Mo.; 3d Friday of March and September.

American Electric Railway Association.—H. C. Donecker, 29 W. 39th St., New York.

American Electric Railway Manufacturers' Assoc.—George Keegan, 165 Broadway, New York. Meetings with Am. Elec. Ry. Assoc.

American Railway Association.—W. F. Allen, 75 Church St., New York, Next meeting, May 21, New York.

American Railway Bridge and Building Association.—C. A. Lichty, C. & N. W., Chicago. Convention, October 21-23, 1913, Montreal.

American Railway Engineering Association.—E. H. Fritch, 900 S. Michigan Ave., Chicago. Convention, March 18-20, 1913, Chicago.

American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony building, Chicago. Convention, June 11-13, Atlantic City, N. J.

American Railway Tool Foremen's Association.—A. R. Davis, Central of Georgia, Macon, Ga.

American Society for Testing Materials.—Prof. E. Marburg, University of Pennsylvania, Philadelphia, Pa.; annual, June, 1913.

American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th St., New York; 1st and 3d Wed., except June and August, New York.

American Society of Engineering Contractors.—J. R. Wemlinger, 13 Park Row, New York; 2d Tuesday of each month, New York.

American Society of Mechanical Engineers.—Calvin W. Rice, 29 W. 39th St., New York.

American Wood Preservers' Association.—F. J. Angier, B. & O., Baltimore, Md. Next convention, January 20-22, 1914, New Orleans, La.

Association of American Railway Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chicago. Annual meeting, May 28, Atlantic City, N. J.

Association of Railway Claim Agents.—J. R. McSherry, C. & E. I., Chicago. Next meeting, May, 1913, Baltimore, Md.

Association of Railway Electrical Engineers.—Jos. A. Andreccetti, C. & N. W. Ry., Chicago. Semi-annual meeting, June, 1913, Atlantic City, N. J.

Association of Railway Telegraph Superintendents.—P. W. Drew, 112 West Adams St., Chicago; annual, May 20, 1913, St. Louis, Mo.

Association of Transportation and Car Accounting Officers.—G. P. Conard, 75 Church St., New York.

Association of Water Line Accounting Officers.—W. R. Evans, Chamber of Commerce, Buffalo, N. Y. Annual meeting, October 8, Philadelphia, Pa.

BRIDGE AND BUILDING SUPPLY MEN'S ASSOCIATION.—H. A. Neally, Joseph Dixon Crucible Co., Jersey City, N. J. Meeting with American Railway Bridge and Building Association.
CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 2d Tuesday in month, except June, July and Aug., Montreal.
CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, 413 Dorchester St., Montreal, Que.; Thursday, Montreal.
CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 841 North 50th Court, Chicago; 2d Monday in month, Chicago.
CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Thurs. in Jan. and 2d Fri. in March, May, Sept., Nov., Buffalo, N. Y.
CIVIL ENGINEERS' SOCIETY OF ST. PAUL.—L. S. Pomeroy, Old State Capitol building, St. Paul, Minn.; 2d Monday, except June, July, August and September, St. Paul.
ENGINEERS' SOCIETY OF PENNSYLVANIA.—E. R. Dasher, Box 704, Harrisburg, Pa.; 1st Monday after 2d Saturday, Harrisburg, Pa.
ENGINEERS' SOCIETY OF WESTERN PENNSYLVANIA.—E. K. Hiles, 803 Fulton building, Pittsburgh; 1st and 3d Tuesday, Pittsburgh, Pa.
FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Richmond, Va. Next convention, June 18, Bluff Point, N. Y.
GENERAL SUPERINTENDENTS' ASSOCIATION OF CHICAGO.—E. S. Koller, 226 W. Adams St., Chicago; Wed. preceding 3d Thurs., Chicago.
INTERNATIONAL RAILWAY CONGRESS.—Executive Committee, 11, rue de Louvain, Brussels, Belgium. Convention, 1915, Berlin.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. G. Hall, 922 McCormick building, Chicago. Annual meeting, May, 1913, Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—Wm. Hall, 829 West Broadway, Winona, Minn. Next convention, July 22-25, Chicago.
INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—A. L. Woodworth, Lima, Ohio. Annual meeting, August 18, Richmond, Va.
MAINTENANCE OF WAY MASTER PAINTERS' ASSOCIATION OF THE UNITED STATES AND CANADA.—W. G. Wilson, Lehigh Valley, Easton, Pa.
MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., New York. Convention, May 26-29, 1913, Chicago.
MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony building, Chicago. Convention, June 16-18, Atlantic City, N. J.
MASTER CAR AND LOCOMOTIVE PAINTERS' ASSOC. OF U. S. AND CANADA.—A. P. Dane, B. & M., Reading, Mass. Annual meeting, September 9-12, Ottawa, Can.
NATIONAL RAILWAY APPLIANCES' ASSOC.—Bruce V. Crandall, 537 So. Dearborn St., Chicago. Meeting with Am. Ry. Eng. Assoc.
NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass.; 2d Tuesday in month, except June, July, Aug. and Sept., Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday in month, except June, July and August, New York.
NORTHERN RAILROAD CLUB.—C. L. Kennedy, C., M. & St. P., Duluth, Minn.; 4th Saturday, Duluth.
PEORIA ASSOCIATION OF RAILROAD OFFICERS.—M. W. Rotchford, Union Station, Peoria, Ill.; 2d Tuesday.
RAILROAD CLUB OF KANSAS CITY.—C. Manlove, 1008 Walnut St., Kansas City, Mo.; 3d Friday in month, Kansas City.
RAILWAY BUSINESS ASSOCIATION.—Frank W. Noxon, 2 Rector St., New York. Annual dinner, second week in December, 1913, New York.
RAILWAY CLUB OF PITTSBURGH.—J. B. Anderson, Penna. R. R., Pittsburgh, Pa.; 4th Friday in month, except June, July and August, Pittsburgh.
RAILWAY ELECTRICAL SUPPLY MANUFACTURERS' ASSOC.—J. Scribner, 1021 Monadnock Block, Chicago. Meetings with Assoc. Ry. Elec. Engrs.
RAILWAY GARDENING ASSOCIATION.—J. S. Butterfield, Lee's Summit, Mo. Next meeting, August 12-15, Nashville, Tenn.
RAILWAY DEVELOPMENT ASSOCIATION.—W. Nicholson, Kansas City, Southern, Kansas City, Mo.
RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, Bethlehem, Pa. Meetings, March 17, Chicago; June 10-11, New York; convention, October 14, Nashville, Tenn.
RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio. Annual convention, May 19-21, Chicago.
RAILWAY SUPPLY MANUFACTURERS' ASSOC.—J. D. Conway, 2135 Oliver bldg., Pittsburgh, Pa. Meetings with M. M. and M. C. B. Assocs.
RAILWAY TEL. AND TEL. APPLIANCE ASSOC.—W. E. Harkness, 284 Pearl St., New York. Meetings with Assoc. of Ry. Teleg. Sups.
RICHMOND RAILROAD CLUB.—F. O. Robinson, Richmond, Va.; 2d Monday except June, July and August.
ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—L. C. Ryan, C. & N. W., Sterling, Ill. Convention, September 8-12, 1913, Chicago.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug., St. Louis.
SIGNAL APPLIANCE ASSOCIATION.—F. W. Edmonds, 3868 Park Ave., New York. Meetings with annual convention Railway Signal Association.
SOCIETY OF RAILWAY FINANCIAL OFFICERS.—C. Nyquist, La Salle St. Station, Chicago.
SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—E. W. Sandwich, A. & W. P. Ry., Montgomery, Ala. Next meeting, April 17, Atlanta, Ga.
SOUTHERN & SOUTHWESTERN RAILWAY CLUB.—A. J. Merrill, Grant bldg., Atlanta, Ga.; 3d Thurs., Jan., March, May, July, Sept., Nov., Atlanta.
TOLEDO TRANSPORTATION CLUB.—J. G. Macomber, Woolson Spice Co., Toledo, Ohio; 1st Saturday, Toledo.
TRACK SUPPLY ASSOCIATION.—W. C. Kidd, Ramapo Iron Works, Hillburn, N. Y. Meeting with Roadmasters' and Maintenance of Way Association.
TRAFFIC CLUB OF CHICAGO.—Guy S. McCabe, La Salle Hotel, Chicago; meetings monthly, Chicago.
TRAFFIC CLUB OF NEW YORK.—C. A. Swope, 290 Broadway, New York; last Tuesday in month, except June, July and August, New York.
TRAFFIC CLUB OF PITTSBURGH.—D. L. Wells, Erie, Pittsburgh, Pa.; meetings monthly, Pittsburgh.
TRAFFIC CLUB OF ST. LOUIS.—A. F. Versen, Mercantile Library building, St. Louis, Mo. Annual meeting in November. Noonday meetings October to May.
TRAIN DESPATCHERS' ASSOCIATION OF AMERICA.—J. F. Mackie, 7042 Stewart Ave., Chicago. Annual meeting, June 17, Los Angeles, Cal.
TRANSPORTATION CLUB OF BUFFALO.—J. M. Sells, Buffalo; first Saturday after first Wednesday.
TRANSPORTATION CLUB OF DETROIT.—W. R. Hurley, L. S. & M. S., Detroit, Mich.; meetings monthly.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R., East Buffalo, N. Y. Annual meeting, August, 1913, Chicago.
UTAH SOCIETY OF ENGINEERS.—R. B. Ketchum, University of Utah, Salt Lake City, Utah; 3d Friday of each month, except July and August.
WESTERN CANADA RAILWAY CLUB.—W. H. Rosevear, P. O. Box 1707, Winnipeg, Man.; 2d Monday, except June, July and August, Winnipeg.
WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony building, Chicago; 3d Tuesday of each month, except June, July and August.
WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, 1735 Monadnock block, Chicago; 1st Monday in month, except July and August, Chicago.

Traffic News.

The Pittsburgh & Lake Erie and the Western Maryland have made a reduction of 15 cents a ton in the freight rate on coal destined to points beyond, by water, from the Pittsburgh district to Baltimore, and the reduction has been followed by a similar reduction over the Baltimore & Ohio. It is expected that the Pennsylvania will meet the new rates in the tariffs from the coal mines adjacent to its lines in western Pennsylvania.

At a meeting of the Western Passenger Association in Chicago, last week, summer tourist rates for this year were decided upon, and will be on approximately the same basis that has been in effect in previous years. From Chicago to Colorado common points the round trip fare will be $30, and to Utah points the round trip rate will be $43. Summer tourist tickets will be on sale from June 1 to September 30, with the return limit on October 31.

At a meeting of traffic officers of the New Orleans railway lines and agents of the steamship lines last week, an agreement was reached by which the steamship lines will pay demurrage charges on shipments of cotton and forest products exported through New Orleans on through bills of lading, after ten days' free time. It is understood that this agreement will end a controversy regarding the issuance of bills of lading which has been in progress for the past year.

INTERSTATE COMMERCE COMMISSION.

Reparation Awarded.

Dewey Brothers Company v. Louisville, Henderson & St. Louis et al. Opinion by the commission:

The rate of 21 cents per 100 lbs. for the transportation of distillers' dried grains in carloads from Stanley, Ky., to Akron, Ohio, was found to have been unreasonable to the extent that it exceeded 15 cents per 100 lbs. (25 I. C. C., 700.)

In re rates on empty beer packages returned.

Pabst Brewing Company v. Chicago, Milwaukee & St. Paul et al. Opinion by the commission:

In this case reparation was sought on certain shipments of empty beer packages on which the commission previously refused to grant reparation. The commission upheld its former decision, with the exception of that in the case of shipments from Hutchinson, Kan., to Milwaukee, Wis., made by the Pabst Brewing Company in 1908 and 1909. The commission found that rates of 29½ cents were applied on five of the shipments in question and 34½ cents on the remaining shipments. The commission found that these rates were unreasonable to the extent that they exceeded 24 cents per 100 lbs., with a minimum of 15,000 lbs. in refrigerator cars and 20,000 lbs. in ordinary box cars. As the present rate is now 22 cents per 100 lbs., no order as to a rate for the future was entered. (26 I. C. C., 4.)

Live Stock Rates.

American National Live Stock Association et al. v. Southern Pacific et al. Opinion by Chairman Prouty:

The commission established reasonable maximum rates for the transportation of live stock from stations in Arizona to Los Angeles and other California points. The rates were prescribed for 36 ft. cars; and to obtain rates for cars of different lengths 3 per cent. per foot should be added or subtracted. To those rates $5 per car should be added for a two-line haul for 500 miles or less; for branch-line hauls $2.50 per car should be added. The rate on stock cattle or on sheep for feeding should be 85 per cent. of the rate prescribed for fat sheep and cattle since in the case of stock cattle the carrier will get a second haul. Through routes were established from points on the Arizona Eastern, via the Southern Pacific, to Los Angeles and California feed lots. (26 I. C. C., 37.)

Rates on Manganese Ore Increased.

In re import rate on manganese ore. Opinion by the commission:

The cancellation of a tariff provision by the Central of New Jersey providing for application of the import rate on ground

manganese ore, ground at Elizabethport, N. J., was suspended. The commission found that the tariff provision in question enabled the complainant to deliver manganese ore to western markets at a considerably lower rate than its competitors, which were compelled to pay the regular rate. The commission therefore decided that the tariff provision was discriminatory in favor of the complainant and directed that the order of suspension be vacated. (25 I. C. C., 663.)

Rates on Porch Work Increased.

In re investigation and suspension of advances in rates by carriers for the transportation of porch work from Beaumont and East Beaumont, Tex., to various interstate points. Opinion by Commissioner Meyer:

The commission suspended the tariffs of the defendant which proposed to cancel joint rates on porch work from Beaumont and East Beaumont, Tex., to various points east of the Mississippi river and to substitute combination rates which are from 8 to 12 cents higher than the present rates. At the hearing no one appeared for the complainant. The main argument for the defense was that the Texas & New Orleans did not receive a fair division of the present through rate. The witness for the defendant said that the rates on porch work should be at least three cents higher per 100 lbs. than the rates on lumber. The commission found that porch work took an arbitrary of three cents per 100 lbs. over lumber from producing points in several other states. The present rates on porch work from Beaumont and East Beaumont are only one cent per 100 lbs. lower than the rates on lumber from those points. The commission decided that the proposed advances are unreasonable, but that the defendants should establish from Beaumont and East Beaumont to eastern destinations to which joint rates on porch work now apply, joint rates which are not more than three cents per 100 lbs. higher than the current rates on lumber between those points. (26 I. C. C., 1.)

News Print Paper Rates Reduced.

In re investigation and suspension of advances in rates by carriers for the transportation of news print paper from Sault Ste. Marie, Ontario, to various points in the United States. Opinion by Commissioner Meyer.

The tariffs under suspension name rates on news print paper in carloads from Sault Ste. Marie, Ont., to points on the Missouri river and in central freight association territory. With two exceptions, the proposed rates are reductions under the current rates. The advances are only 1¼ cents and the reductions range from 1 to 13 cents. The complainant seeks to have the commission, in this proceeding, not only find that the proposed rates are unreasonable, but also to order the defendants to establish rates lower than those now proposed. The main argument of the complainants was based on a comparison with rates in other districts. The commission found that the complainant failed to show that the rates assailed were unreasonable or unjustly discriminatory; and that the defendants had justified the propriety of the rates proposed by them.

The formation of Sault Ste. Marie, Ontario, Sault Ste. Marie, Petoskey, and Cheboygan, Mich., into a single group for rate-making purposes, similar to groups established elsewhere, will largely obviate the difficulties and the seeming inconsistencies dwelt upon by the complainant with respect to the rates on news print paper from such points. (26 I. C. C., 13.)

Rates on Hay Increased.

In re investigation and suspension of advances in rates by carriers for the transportation of hay in carloads from points in Wisconsin to Chicago, Ill., and between other points. Opinion by Commissioner McChord:

The increases in the proposed rates on hay from points in the Northwest to Chicago range from 1½ cents to 5½ cents per 100 lbs. and average about two cents per 100 lbs. Under Western classification hay takes the class C rate, but to Chicago and other terminal markets commodity rates lower than class C have generally obtained. The advances in question bring the rate up to the class C basis in most instances. The commission found that it would have to determine upon the reasonableness of the proposed rate without reference to the classification. The defendant argued that one of the chief reasons for raising the rates on hay was the excessive terminal charges incident to delays in unloading hay. The commission decided that as some consignees were more delinquent than others, these terminal charges should not be included in the rate. It was shown that the proposed rates would yield more per car revenue than the rates on the same commodity in other districts. The commission found that the proposed rates were not unreasonable and they will be permitted to become effective. It was also contended by the complainant that the proposed rates were discriminatory, but as no evidence was introduced in support of this allegation, the commission made no decision in regard to it. (25 I. C. C., 680.)

Rates on Drain Tile and Sewer Pipe.

In re investigation and suspension of advances in rates by carriers for the transportation of drain tile and other articles from points in Central freight association territory to various destinations. Opinion by Commissioner Clements:

By the suspended tariffs the carriers proposed to advance their rates on drain tile and sewer pipe about 20 per cent. The purpose of this advance is to simplify the tariff by making one rate on all tile not classed as sewer pipe. The complainant contends that the cheaper grade of tile should continue to enjoy its lower rate as at present. The commission found that the proposed advances on drain tile were excessive and ordered the defendant to cancel them. The commission intimated that although the present advances are unreasonable, smaller advances might be permitted if it could be shown that they would simplify the tariff and also be reasonable.

In regard to sewer pipe, the testimony was with particular reference to the rate from Mecca, Ind., to Chicago, Ill., which the carriers proposed to advance from 6 to 8 cents per 100 lbs. The complainant contended that the rate of 12 cents per 100 lbs. from Akron, Ohio, to Chicago was not advanced, therefore it would not be fair to advance the rate from Mecca. The rate from Akron is on the basis of sixth class, and the proposed increased rate from Mecca is one cent less than sixth class. The commission found that the proposed increases in rates on sewer pipe were reasonable and as far as they are concerned the order of suspension will be vacated. (26 I. C. C., 88.)

STATE COMMISSIONS.

The Railroad Commission of Indiana has issued a code of rules, regulations and charges for the storage of freight, to go into effect February 15.

The Public Service Commission of Ohio has issued a code of demurrage regulations for freight cars and has directed all of the roads in the state to put them in force on April 1, next.

The Nevada railway commission has ordered the Southern Pacific to reduce its present local one-way passenger fares between all points on its standard gage main and branch lines in the state from 4 and 5 cents a mile to 3 cents a mile. The chairman of the commission dissented from the majority, stating that while he is favorable to the reduction on the main line, he is opposed to any reduction on the branches.

The New Mexico corporation commission has filed with the Interstate Commerce Commission a complaint attacking all the interstate rates from the Missouri river and Pacific coast points to New Mexico as unreasonable and discriminatory as compared with the rates to Texas and other points. The commission requests that hearings be held before the entire membership of the Interstate Commerce Commission.

The governor of New York has appointed Edward E. McCall, hitherto a justice of the Supreme Court, to the position of chairman of the Public Service Commission, First district (New York City), in place of William R. Wilcox, whose term has expired. Political influences and the interests of the democratic party seem to have been the controlling factors in this appointment. The governor on the same day, February 3, appointed Devoe P. Hodson, of Buffalo, to succeed John B. Olmsted, as a member of the Public Service Commission for the Second district.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF NOVEMBER, 1912.

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Passenger.	Total. inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Denver & Rio Grande	2,560a	$1,782,886	$443,059	$2,322,695	$239,231	$370,000	$45,437	$730,368	$54,374	$1,439,410	$883,285	—$4,623	$93,750	$784,912	$282,026
Oahu Railway and Land Co	101b	47,049	21,931	73,657	11,004	5,743	650	18,840	2,820	39,057	34,600	—7,702	6,500	20,398	1,652
Pere Marquette	2,330c	1,126,974	303,523	1,548,917	310,797	347,811	33,748	659,581	34,009	1,385,946	162,971	—2,240	56,933	103,798	—197,080
FIVE MONTHS OF FISCAL YEAR, 1913.															
Denver & Rio Grande	2,560a	$8,413,622	$2,598,974	$11,522,007	$1,631,150	$1,920,551	$246,511	$3,537,815	$288,980	$7,625,007	$3,897,000	$21,718	$388,750	$3,529,968	$693,356
Oahu Railway and Land Co	101b	362,521	110,803	506,073	45,719	30,847	2,631	103,371	20,220	202,788	303,285	—14,571	32,500	256,214	53,488
Pere Marquette	2,330c	5,038,155	1,994,491	7,683,203	1,142,903	1,307,991	174,657	3,040,825	182,486	5,848,862	1,834,341	24,611	285,084	1,573,868	—184,299
MONTH OF DECEMBER, 1912.															
Alabama & Vicksburg	143	$109,193	$51,494	$171,485	$22,978	$25,854	$3,757	$59,722	$5,671	$117,982	$53,503	$25	$6,737	$46,791	$7,437
Atchison, Topeka & Santa Fe	8,202[1]	5,637,552	2,291,158	8,607,535	1,415,626	1,418,039	185,147	2,528,738	163,725	5,711,275	2,896,260	.....	355,011	2,541,249	356,452
Atlanta & West Point	93	55,144	44,147	110,990	10,943	17,579	5,180	35,091	5,478	74,271	36,719	70	8,010	28,709	—1,073
Atlantic Coast Line	4,612[2]	2,360,026	884,867	3,512,375	393,955	446,547	53,225	1,109,506	79,317	2,082,550	1,429,825	.....	125,000	1,304,825	72,467
Baltimore & Ohio—System	4,455[3]	6,508,113	1,290,574	8,303,097	947,218	1,481,189	154,734	3,233,326	162,151	5,978,618	2,324,479	—98,997	238,137	1,987,345	163,634
Bangor & Aroostook	631[4]	204,195	50,848	269,100	38,827	34,784	2,415	80,579	15,048	171,653	97,447	.....	10,500	86,947	17,221
Bessemer & Lake Erie	204	409,603	25,985	448,035	82,933	124,912	9,701	149,050	24,104	400,700	47,335	.....	15,000	32,335	3,212
Buffalo, Rochester & Pittsburgh	574[5]	696,041	94,166	816,563	83,221	168,188	11,826	300,001	19,400	582,636	233,927	—279	17,000	216,648	—14,759
Carolina, Clinchfield & Ohio	238	170,048	15,392	189,076	11,973	17,700	6,362	35,427	7,563	79,025	110,051	.....	8,000	102,051	16,615
Carolina, Clinch. & Ohio Ry. Co. of S. C.	18	15,003	2,080	17,330	731	80	1,031	2,552	458	4,852	12,478	.....	500	11,978	6,166
Central of New Jersey	669[6]	1,713,340	408,537	2,238,875	189,101	334,076	27,928	718,592	47,909	1,317,606	921,269	—17,483	84,466	819,320	—11,400
Central New England	277	259,645	27,406	303,050	35,848	30,819	1,052	71,827	3,884	143,430	159,620	—56	10,000	149,564	13,229
Chesapeake & Ohio Lines	2,324[7]	2,321,710	486,723	2,976,993	291,783	684,925	59,367	989,084	67,681	2,092,840	884,153	13,346	102,155	795,344	—165,019
Chicago & Alton	1,026	810,026	363,218	1,261,566	229,619	365,410	45,438	517,983	33,285	1,191,735	69,831	—2,428	39,700	29,703	—170,418
Chicago & Northwestern	7,976[8]	4,345,245	1,714,698	6,748,996	737,262	978,261	111,398	2,691,894	128,372	4,647,187	2,101,809	—2,339	303,000	1,796,470	626,251
Chicago, Burlington & Quincy	9,129[9]	5,553,960	1,846,460	8,128,415	645,395	1,380,394	130,685	2,733,898	200,379	5,090,751	3,037,664	—13,715	274,587	2,749,362	459,003
Chicago Great Western	1,496	843,086	265,007	1,192,315	114,948	165,108	42,853	485,536	37,237	845,682	346,633	—60	35,040	311,533	61,630
Chicago, Indianapolis & Louisville	617	400,519	138,184	592,912	71,923	82,171	19,948	227,148	17,521	418,711	174,201	.....	22,640	151,561	70,979
Chicago Junction	12	.....	.....	169,714	15,085	13,241	1,119	81,407	3,430	114,282	55,432	.....	320	55,112	17,795
Chicago, Milwaukee & Puget Sound	2,081[10]	1,618,018	273,216	1,951,920	133,825	236,197	44,045	628,966	27,830	1,070,863	881,057	11,099	75,000	817,156	355,581
Chicago, Milwaukee & St. Paul	7,511	4,456,117	1,312,251	6,361,374	568,255	963,240	127,668	2,601,942	86,451	4,346,556	2,014,818	6,195	254,360	1,766,553	319,081
Chicago, Rock Island & Gulf	477	224,680	69,384	311,274	26,874	23,454	9,070	117,865	8,467	185,730	125,544	—753	5,581	119,210	51,875
Chicago, Rock Island & Pacific	7,566[11]	3,744,073	1,717,283	5,803,345	804,794	834,653	161,379	2,418,299	139,243	4,358,368	1,444,977	—18,136	248,413	1,178,428	20,214
Chicago, St. Paul, Minneapolis & Omaha	1,744	872,899	435,281	1,412,322	108,776	184,668	33,838	597,928	30,196	955,406	456,916	—1,657	70,857	384,402	9,163
Cincinnati, Hamilton & Dayton	1,015	641,711	131,061	860,399	86,378	149,536	21,227	404,500	20,568	682,209	178,190	.....	39,113	139,077	—5,882
Cumberland Valley	162	210,299	55,021	278,602	54,115	38,980	4,134	106,739	12,430	216,398	62,204	53	8,969	53,288	—7,132
Delaware, Lackawanna & Western	959	2,536,821	673,337	3,438,977	282,800	520,011	67,163	1,112,964	72,697	2,055,635	1,383,342	68,061	.....	1,451,403	342,715
Detroit & Mackinac	411[12]	59,731	29,689	96,726	11,767	15,967	2,118	35,325	2,878	68,055	28,671	—61	8,916	19,694	6,194
Duluth & Iron Range	274[13]	80,457	25,077	114,749	33,616	24,196	768	72,843	29,490	160,913	—46,164	—2,060	13,267	—61,491	38,440
Duluth, Missabe & Northern	356[14]	84,005	47,675	136,857	72,579	67,654	2,357	80,577	26,134	249,301	—112,444	—5,527	9,909	—127,880	—78,436
El Paso & Southwestern Co	968[15]	640,975	100,610	776,952	83,930	90,794	14,019	214,087	28,579	431,409	345,543	—3,998	43,215	298,330	49,790
Elgin, Joliet & Eastern	802[16]	1,036,077	11	1,111,871	121,317	170,575	5,531	341,420	32,936	671,779	446,092	.....	29,335	410,757	164,268
Florida East Coast	642[17]	228,072	148,496	423,849	58,452	55,845	15,728	140,940	11,382	282,347	141,502	—1,454	15,500	124,548	17,114
Fort Worth & Denver City	454	344,814	156,679	524,356	62,138	85,618	6,498	164,614	16,073	334,941	189,415	—727	11,700	176,988	31,907
Great Northern	7,774[18]	4,819,866	1,285,532	6,548,454	643,667	791,307	106,723	1,794,093	112,537	3,448,327	3,100,127	4,366	386,833	2,717,660	768,182
Gulf & Ship Island	308	116,466	38,653	166,849	21,583	27,998	2,083	44,462	8,214	104,340	62,509	.....	9,019	53,490	—3,750
Illinois Central	4,763	3,752,987	1,238,558	5,658,190	586,077	1,035,575	117,809	2,224,971	121,449	4,085,881	1,572,309	—8,832	237,750	1,325,727	708,223
International & Great Northern	1,159	690,039	232,245	982,660	147,282	124,725	23,768	446,432	32,445	774,652	208,008	—1,941	30,000	176,067	—186,502
Lake Erie & Western	886	423,271	75,097	530,439	76,974	99,366	11,105	218,736	12,046	418,227	112,212	.....	20,548	91,664	3,518
Lake Shore & Michigan Southern	1,873[19]	3,387,545	1,030,443	5,019,375	467,105	911,793	79,499	1,739,973	83,694	3,282,064	1,737,311	—4,897	201,098	1,531,316	59,225
Lehigh & Hudson River	97	145,394	3,668	157,242	11,743	24,017	1,553	61,992	5,617	104,922	52,320	.....	4,000	48,320	4,798
Lehigh Valley	1,452[20]	2,948,477	393,786	3,461,355	494,828	549,678	73,685	1,247,908	94,746	2,460,845	1,000,510	—18,933	117,500	864,077	90,222
Long Island	399	270,270	477,588	793,222	111,765	93,936	13,207	406,704	29,017	654,629	138,593	53,326	62,124	129,795	33,946
Louisville & Nashville	4,723[21]	3,570,903	1,142,838	5,054,306	831,898	921,172	101,697	1,688,335	124,060	3,667,162	1,387,144	—441	159,242	1,227,461	—95,382
Louisville, Henderson & St. Louis	200	65,015	30,805	102,877	23,665	11,283	3,727	41,103	3,845	83,623	19,254	445	3,000	16,699	—1,092
Maine Central	1,204[22]	559,296	252,597	868,499	108,736	126,039	8,011	352,130	28,166	623,082	245,417	—22,354	42,900	180,163	—9,553
Michigan Central	1,817[23]	1,999,778	726,335	3,050,834	295,884	458,846	75,187	1,266,767	73,343	2,170,027	880,807	3,688	100,985	783,510	210,728
Midland Valley	373	78,046	46,475	130,694	31,660	21,491	3,009	42,802	6,010	104,972	25,722	278	8,473	17,527	—18,708

Average mileage operated during previous period—a 2,556; b 99; c 2,331; [1] 7,613; [2] 4,524; [3] 4,434; [4] 628; [5] 572; [6] 672; [7] 2,242; [8] 7,860; [9] 9,074; [10] 2,059; [11] 7,551; [12] 358; [13] 263; [14] 342; [15] 902; [16] 842; [17] 583; [18] 7,345; [19] 1,776; [20] 1,434; [21] 4,705; [22] 1,180; [23] 1,805. — Indicates Deficits, Losses and Decreases.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF DECEMBER, 1912—CONTINUED.

Name of road.	Average mileage operated during period.	Operating revenues: Freight.	Passenger.	Total. inc. misc.	Operating expenses: Maintenance: Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.	Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
Minneapolis & St. Louis	1,586	$630,695	$157,652	$840,281	$114,537	$96,697	$18,552	$336,477	$21,840	$588,103	$252,178	—$27	$32,236	$219,915	$98,753
Missouri Pacific	3,319[24]	1,747,099	442,669	2,373,474	320,232	401,763	62,359	1,023,030	65,492	1,872,876	500,598	—2,567	98,190	399,841	257,272
Monongahela	65	137,065	2,748	141,780	11,033	6,881	257	27,908	2,044	48,123	93,657	.....	3,043	90,614	31,777
Nevada Northern	165	119,753	17,466	141,281	12,705	14,813	610	31,819	3,226	63,173	78,108	.....	5,960	72,148	25,946
New Orleans & North Eastern	196	212,587	59,444	294,987	28,321	58,464	10,014	118,900	13,237	228,936	66,051	201	13,832	52,420	—34,716
New Orleans, Mobile & Chicago	547[25]	195,581	34,557	241,300	30,306	21,159	3,190	82,747	9,953	147,355	93,945	33	4,161	89,817	22,982
New York Central & Hudson River	3,597[26]	5,746,048	2,688,348	9,481,298	1,075,577	1,717,119	196,997	3,713,137	248,453	6,951,283	2,530,015	61,517	338,826	2,252,706	488,973
New York, New Haven & Hartford	2,091	2,822,638	2,193,046	5,581,601	673,724	779,935	30,184	2,446,190	223,033	4,153,066	1,428,535	137,633	320,000	1,246,168	—529,563
New York, Philadelphia & Norfolk	112	219,756	45,774	288,236	19,586	49,934	4,616	129,956	13,655	217,747	70,489	.....	8,900	61,589	9,841
Norfolk & Western	2,019[27]	3,027,557	417,476	3,566,509	380,807	611,831	56,122	1,084,086	64,785	2,197,631	1,368,878	—1,830	120,000	1,247,048	196,813
Norfolk Southern	562	178,366	80,424	282,113	34,821	35,808	4,081	89,992	15,878	180,580	101,533	—603	7,510	93,420	1,060
Northern Central	472[28]	873,456	192,647	1,139,280	70,679	211,367	14,835	547,286	30,700	874,867	264,413	368	9,504	255,277	138,149
Northern Pacific	6,241[29]	4,683,590	1,289,135	6,355,776	512,676	709,020	102,181	2,083,459	85,841	3,493,177	2,862,599	52,610	340,550	2,574,659	503,278
Pennsylvania *Co.*	1,751[30]	3,988,070	834,648	5,300,813	820,267	1,138,846	80,504	1,976,069	103,380	4,119,066	1,181,747	—4,558	284,925	892,264	188,528
Pennsylvania *Railroad*	4,025[31]	10,970,055	2,972,315	14,993,391	2,019,063	3,409,161	215,269	5,665,818	382,698	11,692,009	3,301,382	—137,643	750,130	2,413,609	—320,178
Philadelphia, Baltimore & Washington	713	776,849	702,038	1,664,946	277,875	316,091	30,505	734,029	51,208	1,409,708	255,238	.....	60,984	194,254	—42,690
Pittsburgh, Cincinnati, Chic. & St. Louis	1,467	2,709,617	764,609	3,882,447	574,490	779,543	64,910	1,477,557	75,511	2,972,011	910,436	—924	141,692	767,820	43,015
Pittsburgh, Shawmut & Northern	279[32]	162,799	9,821	175,853	22,197	36,135	1,159	58,285	3,566	121,342	54,511	.....	1,595	52,916	12,381
Richmond, Fredericksburg & Potomac	88[33]	137,347	83,639	250,925	17,660	23,840	3,332	92,100	6,977	142,909	107,016	—687	805	105,524	22,793
St. Louis & San Francisco	4,742[34]	2,535,471	1,053,407	3,850,791	473,359	438,899	79,507	1,326,271	100,386	2,418,422	1,432,369	.....	172,432	1,259,937	243,966
St. Louis, Iron Mountain & Southern	3,318[35]	2,187,973	639,131	3,004,396	499,777	401,031	57,120	941,768	65,862	1,965,558	1,038,838	—3,752	88,695	946,391	43,565
St. Louis Merchants' Bridge Terminal	9	.....	334	195,202	30,622	12,979	586	97,857	5,264	147,308	47,894	.....	5,150	62,744	39,333
St. Louis, San Francisco & Texas	244	108,104	32,868	147,887	22,044	15,158	2,346	59,108	6,256	104,912	42,975	.....	Cr. 821	43,796	8,630
Seaboard	3,070[36]	1,467,338	492,447	2,165,596	285,904	288,512	65,638	769,458	62,908	1,472,420	693,176	—3,090	81,000	609,086	67,665
Southern	7,036[37]	3,972,207	1,757,015	6,223,385	758,817	938,941	169,371	2,060,318	185,295	4,112,742	2,110,643	5,037	227,263	1,888,417	107,223
Terminal R. R. Ass'n of St. Louis	34[38]	.....	278	259,659	38,958	22,547	905	99,475	5,563	167,448	92,211	7,772	21,988	77,995	32,481
Union Pacific	3,575[39]	3,080,693	894,870	4,375,519	440,859	545,622	83,594	1,221,150	115,101	2,406,326	1,969,193	—4,752	213,302	1,751,139	429,439
Union R. R. of Baltimore	9	133,340	21,841	157,006	7,628	.....	884	5,486	2,788	16,786	140,220	.....	7,616	132,604	40,162
Union R. R. of Pennsylvania	31	.....	.....	278,503	23,366	89,966	100	150,096	11,555	275,083	3,420	4,544	6,000	1,964	16,577
Vicksburg, Shreveport & Pacific	171	85,253	59,411	158,313	26,269	22,738	3,259	49,721	5,123	107,110	51,203	—176	4,335	46,692	8,678
Virginian	503[40]	412,640	29,839	456,195	56,879	85,394	4,916	121,448	8,769	277,406	178,789	6,333	17,600	167,522	43,507
Washington Southern	36	42,174	40,653	113,497	10,582	13,243	1,358	44,357	2,956	72,496	41,001	—1,410	4,041	35,550	4,218
West Jersey & Seashore	356	133,204	203,446	362,581	29,174	79,942	21,027	205,432	14,828	350,403	12,178	—669	8,014	3,495	—14,708
Western Ry. of Alabama	133	64,252	53,602	127,777	16,125	19,336	6,292	32,998	6,695	81,446	46,331	26	5,184	41,173	650

SIX MONTHS OF FISCAL YEAR, 1913.

Alabama & Vicksburg	143	$616,034	$265,176	$942,763	$135,369	$158,417	$21,913	$321,419	$34,140	$671,258	$271,505	—$1,032	$37,861	$232,612	$35,420
Atchison, Topeka & Santa Fe	8,202[1]	34,206,595	12,914,245	50,899,616	8,432,877	8,422,357	1,002,864	14,183,731	978,576	33,020,405	17,879,211	.....	2,038,754	15,840,457	1,850,270
Atlanta & West Point	93	322,084	259,742	642,778	80,308	111,555	31,776	205,784	30,559	459,982	182,796	776	38,064	145,508	—23,014
Atlantic Coast Line	4,612[2]	11,447,554	4,277,170	16,978,452	2,409,631	2,725,893	294,568	6,054,418	452,248	11,936,758	5,041,694	.....	750,000	4,291,694	—367,216
Baltimore & Ohio—System	4,455[3]	41,017,583	8,440,714	52,449,337	7,160,617	9,105,153	971,716	18,195,814	993,809	36,425,109	16,024,228	—452,481	1,385,387	14,186,360	981,359
Bangor & Aroostook	631[4]	1,139,014	364,626	1,596,751	286,285	186,283	21,287	477,734	72,222	1,043,811	552,940	.....	63,000	489,940	—61,294
Bessemer & Lake Erie	204	4,753,346	210,400	5,030,864	500,137	801,228	57,730	1,149,976	71,138	2,580,209	2,450,655	.....	66,000	2,384,655	117,430
Buffalo, Rochester & Pittsburgh	574[5]	4,811,332	620,021	5,655,599	853,553	1,109,546	70,802	1,773,461	111,203	3,918,565	1,737,034	—1,278	102,000	1,633,756	138,840
Carolina, Clinchfield & Ohio	238	1,109,060	90,154	1,232,483	84,498	121,143	40,351	210,013	42,902	498,907	733,576	.....	48,000	685,576	161,983
Carolina, Clinch. & Ohio Ry. Co. of S. C.	18	66,404	10,625	78,448	4,467	546	6,194	14,709	2,418	28,334	50,114	.....	3,000	47,114	13,942
Central of New Jersey	669[6]	11,130,321	2,997,396	14,915,071	1,260,871	2,042,764	189,157	4,337,730	255,373	8,085,895	6,829,176	66,334	690,702	6,204,808	693,865
Central New England	277	1,650,074	183,867	1,920,421	277,689	153,675	7,451	484,060	19,149	942,024	978,397	—13	60,000	918,384	134,838
Chesapeake & Ohio Lines	2,324[7]	13,974,854	3,165,775	17,964,632	2,151,974	3,738,690	337,453	5,439,925	395,267	12,063,309	5,901,323	31,312	612,930	5,319,705	—200,403
Chicago & Alton	1,026	5,343,578	2,286,211	8,204,885	1,195,658	1,784,977	257,279	2,839,529	193,518	6,270,961	1,933,924	14,064	229,700	1,690,160	—193,609
Chicago & Northwestern	7,976[8]	28,712,045	11,191,217	43,854,869	5,724,991	5,919,233	683,527	16,164,388	761,986	29,254,125	14,600,744	15,993	1,818,000	12,798,737	2,097,979
Chicago, Burlington & Quincy	9,129[9]	34,261,337	12,109,961	50,713,686	5,452,485	8,061,261	807,541	15,064,633	1,286,422	30,672,342	20,041,344	—61,584	1,662,192	18,317,568	3,215,131
Chicago Great Western	1,496	5,017,688	1,719,855	7,280,788	876,893	990,648	275,962	2,754,515	206,856	5,104,874	2,175,914	—287	210,582	1,965,045	246,174
Chicago, Indianapolis & Louisville	617	2,436,375	908,245	3,666,189	511,391	458,565	110,407	1,322,644	92,400	2,495,407	1,170,782	.....	138,873	1,031,909	78,714
Chicago Junction	12	.....	.....	1,016,806	117,403	69,012	7,243	463,582	21,690	678,930	337,876	.....	9,377	328,499	51,099
Chicago, Milwaukee & Puget Sound	2,081[10]	9,424,070	1,699,007	11,498,592	941,399	1,230,021	284,080	3,389,736	139,108	5,984,344	5,514,248	85,364	450,000	5,149,612	1,886,149
Chicago, Milwaukee & St. Paul	7,511	26,903,520	8,566,024	39,004,166	4,730,194	5,266,772	705,436	14,132,361	459,136	25,293,899	13,710,267	63,118	1,432,773	12,340,612	4,418,585
Chicago, Rock Island & Gulf	477	1,299,897	365,685	1,770,990	212,971	144,410	60,702	581,181	47,802	1,047,066	723,924	—3,813	41,136	678,975	48,086
Chicago, Rock Island & Pacific	7,566[11]	23,881,550	10,449,397	36,450,934	5,486,031	4,995,749	939,327	13,785,710	828,106	26,034,923	10,416,011	—92,668	1,435,459	8,887,884	1,239,091

Average mileage operated during previous period—[24] 3,915; [25] 404; [26] 3,591; [27] 2,005; [28] 473; [29] 6,019; [30] 1,416; [31] 3,981; [32] 240; [33] 83; [34] 4,732; [35] 3,314; [36] 3,054; [37] 7,089; [38] 35; [39] 3,537; [40] 475; [1] 7,613; [2] 4,524; [3] 4,434; [4] 628; [5] 572; [6] 672; [7] 2,242; [8] 7,860; [9] 9,074; [10] 2,059; [11] 7,551. — Indicates Deficits, Losses and Decreases.

REVENUES AND EXPENSES OF RAILWAYS.

SIX MONTHS OF FISCAL YEAR, 1913—CONTINUED.

Name of road.	Average mileage operated during period.	Operating revenues			Operating expenses						Net operating revenue (or deficit).	Outside operations, net.	Taxes.	Operating income (or loss).	Increase (or decr.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total. inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Chicago, St. Paul, Minneapolis & Omaha	1,744	$5,828,104	$2,740,697	$9,163,495	$1,271,480	$1,118,516	$175,328	$3,417,282	$190,835	$6,173,441	$2,990,054	$2,919	$422,428	$2,570,545	$289,928
Cincinnati, Hamilton & Dayton	1,015	4,109,941	899,060	5,579,335	620,130	916,747	121,364	2,202,737	116,420	3,977,398	1,601,937	.....	216,090	1,385,847	61,715
Cumberland Valley	162	1,296,912	381,173	1,757,056	320,924	207,467	27,034	555,117	49,939	1,160,481	596,575	1,737	37,027	561,285	85,888
Delaware, Lackawanna & Western	959	15,554,493	4,312,271	21,246,299	2,585,426	3,056,040	400,222	6,304,630	389,757	12,736,075	8,510,224	349,610	758,340	8,101,494	1,272,640
Detroit & Mackinac	411[12]	398,538	191,082	634,086	100,580	82,617	13,410	219,653	17,646	433,906	200,180	1,959	52,968	149,171	22,673
Duluth & Iron Range	274[13]	4,351,944	128,680	4,536,786	479,397	363,672	6,157	911,474	82,135	1,842,835	2,693,951	23,981	218,745	2,499,187	—7,700
Duluth, Missabe & Northern	356[14]	5,016,915	239,244	5,304,869	496,272	499,915	12,332	957,072	83,418	2,049,009	3,255,860	20,947	252,206	3,024,601	529,468
El Paso & Southwestern Co	968[15]	351,184	515,454	4,220,916	427,452	546,672	77,571	1,095,292	153,409	2,300,396	1,920,520	—12,806	175,606	1,732,108	476,718
Elgin, Joliet & Eastern	802[16]	6,140,491	39	6,647,738	700,272	977,488	28,784	1,744,612	112,216	3,563,372	3,084,366	.....	137,000	2,947,366	1,021,674
Florida East Coast	642[17]	1,032,188	627,702	1,899,536	390,072	317,506	40,957	737,149	67,156	1,552,840	346,696	—6,983	93,000	246,713	57,764
Fort Worth & Denver City	454	1,906,444	885,622	2,924,599	253,951	465,038	43,809	903,279	87,802	1,753,879	1,170,720	—2,964	70,200	1,097,556	43,422
Great Northern	7,774[18]	33,179,393	8,250,037	44,110,728	5,670,991	4,661,338	597,178	10,943,667	645,203	22,518,377	21,592,351	138,277	2,005,173	19,725,455	2,746,294
Gulf & Ship Island	308	715,217	220,542	1,007,411	145,053	184,119	16,016	273,515	50,233	668,936	338,475	.....	34,321	304,154	3,391
Illinois Central	4,763	21,808,130	7,184,640	33,185,040	4,639,097	7,094,930	687,956	12,512,485	762,742	25,697,210	7,487,830	—61,078	1,426,500	6,000,252	1,487,276
International & Great Northern	1,159	4,671,428	1,432,262	6,466,505	814,902	789,694	153,371	2,435,968	194,308	4,388,243	2,078,262	—12,764	180,000	1,885,498	.....
Lake Erie & Western	886	2,521,946	491,004	3,186,070	450,491	533,948	73,744	1,157,293	67,731	2,283,207	902,863	.....	123,131	779,732	117,779
Lake Shore & Michigan Southern	1,873[19]	19,455,480	6,582,710	29,237,697	3,542,399	4,806,780	499,879	8,911,967	471,301	18,232,326	11,005,371	112,799	931,098	10,187,072	794,765
Lehigh & Hudson River	97	866,240	26,635	919,128	130,201	131,244	7,885	317,565	26,185	613,080	306,048	.....	24,000	282,048	16,526
Lehigh Valley	1,452[20]	19,127,315	2,672,582	22,542,679	3,110,918	3,589,863	484,914	6,960,408	414,577	14,560,680	7,981,999	—68,932	705,000	7,208,067	1,132,532
Long Island	399	1,851,709	4,115,748	6,268,589	780,621	639,594	95,244	2,521,604	136,852	4,173,915	2,094,674	398,836	344,374	2,149,136	281,747
Louisville & Nashville	4,723[21]	21,407,935	6,646,180	29,926,315	4,859,571	5,653,469	623,082	9,561,388	658,828	21,356,338	8,569,977	—12,876	925,450	7,631,651	—713,819
Louisville, Henderson & St. Louis	200	390,124	207,045	637,872	172,433	82,773	26,375	233,441	18,961	533,983	103,889	1,707	18,000	87,596	—68,353
Maine Central	1,204[22]	3,532,817	2,020,003	5,912,818	1,019,658	773,874	66,450	2,097,916	148,462	4,106,360	1,806,458	—13,107	257,345	1,536,006	70,231
Michigan Central	1,817[23]	11,217,229	4,660,381	17,674,360	2,087,622	2,471,721	397,246	6,713,091	307,260	11,976,940	5,697,420	26,667	670,985	5,053,102	10,875
Midland Valley	373	529,492	256,964	827,177	201,392	125,008	15,782	257,185	33,734	633,101	194,076	1,957	35,812	160,221	—4,607
Minneapolis & St. Louis	1,586	3,843,115	1,021,196	5,151,027	672,342	635,587	105,138	1,935,881	126,590	3,475,538	1,675,489	—189	185,761	1,489,539	564,181
Missouri Pacific	3,319[24]	11,204,163	2,776,927	15,167,002	2,416,336	2,650,892	363,575	6,066,717	410,382	11,907,902	3,259,100	—17,049	565,140	2,676,911	1,821,702
Monongahela	65	793,288	14,970	818,307	100,657	55,972	2,032	155,205	11,932	325,798	492,509	.....	14,044	478,465	168,165
Nevada Northern	165	672,992	96,239	791,876	92,571	86,880	2,484	164,353	20,755	367,043	424,833	.....	36,706	388,127	56,249
New Orleans & North Eastern	196	1,353,963	330,757	1,818,230	195,654	357,032	59,339	714,109	73,260	1,399,394	418,836	446	77,332	341,950	—146,683
New Orleans, Mobile & Chicago	547[25]	1,016,207	190,804	1,280,775	196,382	124,721	19,983	434,994	47,115	823,195	457,580	—357	24,936	432,287	94,678
New York Central & Hudson River	3,597[26]	34,662,429	18,063,584	58,740,933	7,914,913	10,633,812	1,137,970	20,328,541	1,356,610	41,371,846	17,369,087	269,215	2,995,635	14,642,667	594,667
New York, New Haven & Hartford	2,091	17,735,281	14,823,155	35,880,176	3,971,715	4,320,642	189,363	13,238,772	919,975	22,640,467	13,239,709	784,199	1,961,000	12,062,908	1,003,032
New York, Philadelphia & Norfolk	112	1,450,125	275,035	1,870,046	149,643	320,894	25,044	783,670	76,383	1,355,634	514,412	.....	47,400	467,012	28,518
Norfolk & Western	2,019[27]	18,879,757	2,556,748	22,138,936	2,912,723	3,979,397	332,182	6,344,876	406,264	3,975,442	8,163,494	—17,418	720,000	7,426,076	700,949
Norfolk Southern	562	1,035,409	437,942	1,616,302	189,592	217,872	28,871	500,740	87,791	1,024,866	591,436	—8,852	45,059	538,025	21,773
Northern Central	472[28]	5,109,732	1,290,141	6,834,113	749,090	1,245,635	96,715	3,143,277	158,435	5,393,152	1,440,961	4,677	247,598	1,198,040	246,427
Northern Pacific	6,241[29]	28,742,233	8,649,849	39,721,737	5,095,396	4,300,503	612,638	11,947,929	503,547	22,460,013	17,261,724	258,881	1,899,717	15,620,888	1,945,413
Pennsylvania *Co.*	1,751[30]	26,943,990	5,216,327	35,450,703	5,393,884	6,087,247	499,717	11,529,141	584,716	24,094,705	11,355,998	—18,913	1,473,026	9,864,059	1,867,885
Pennsylvania *Railroad*	4,025[31]	67,212,649	19,267,716	92,577,483	11,640,938	19,260,937	1,167,833	31,935,647	2,097,273	66,102,628	26,474,855	—447,746	3,776,436	22,250,673	1,913,328
Philadelphia, Baltimore & Washington	713	5,429,330	4,297,506	10,777,445	1,727,585	1,834,310	165,418	4,326,831	267,287	8,321,431	2,456,014	.....	335,588	2,120,426	—188,681
Pittsburgh, Cincinnati, Chic. & St. Louis	1,467	16,573,602	4,394,865	23,345,702	3,554,258	4,268,792	423,374	8,041,722	422,385	16,710,531	6,635,171	—4,680	852,145	5,778,346	516,751
Pittsburgh, Shawmut & Northern	279[32]	860,852	59,952	937,184	125,856	203,043	7,041	289,365	22,675	647,980	289,204	.....	9,537	279,667	52,023
Richmond, Fredericksburg & Potomac	88[33]	720,771	458,387	1,350,573	156,514	162,561	17,631	489,295	40,559	866,560	484,013	—687	4,467	478,859	74,750
St. Louis & San Francisco	4,742[34]	15,287,356	5,912,712	22,722,092	2,967,797	2,891,950	467,412	7,793,690	611,201	14,732,050	7,990,042	.....	1,026,683	6,963,359	607,380
St. Louis, Iron Mountain & Southern	3,318[35]	13,019,743	3,421,593	17,680,644	3,227,422	2,625,716	322,748	5,422,831	410,922	12,009,639	5,671,005	—27,263	542,670	5,101,072	824,745
St. Louis Merchants' Bridge Terminal	9	.....	2,170	1,091,777	176,519	46,079	3,948	528,665	38,185	792,396	299,381	.....	35,651	263,730	148,712
St. Louis, San Francisco & Texas	244	578,123	198,500	822,472	144,471	97,951	15,172	315,400	32,615	605,609	216,863	.....	5,988	210,875	77,789
Seaboard	3,070[36]	7,910,527	2,581,452	11,655,269	1,642,026	1,610,578	376,332	4,200,494	351,455	8,180,885	3,474,384	—15,934	486,000	2,972,450	102,303
Southern	7,036[37]	22,849,155	9,699,490	35,250,019	4,519,869	5,730,472	991,940	11,495,078	997,545	23,734,904	11,515,115	24,272	1,238,973	10,300,414	513,109
Terminal R. R. Ass'n of St. Louis	34[38]	.....	1,702	1,551,360	232,732	95,885	5,476	551,944	42,521	928,558	622,802	66,651	165,489	523,964	156,678
Union Pacific	3,575[39]	20,451,762	5,827,541	28,629,376	2,870,044	3,100,364	517,095	7,192,948	649,393	14,329,844	14,299,532	—5,783	1,117,778	13,175,971	1,680,339
Union R. R. of Baltimore	9	718,066	139,142	867,028	60,198	.....	4,808	31,596	16,226	112,828	754,200	.....	33,841	720,359	100,691
Union R. R. of Pennsylvania	31	.....	.....	2,530,705	174,067	509,001	704	859,536	26,396	1,569,704	961,001	14,200	34,250	940,951	99,532
Vicksburg, Shreveport & Pacific	171	517,747	286,195	873,788	178,173	146,810	19,456	257,995	30,334	632,768	241,020	—2,954	33,834	204,232	38,974
Virginian	503[40]	2,441,593	160,876	2,677,106	357,315	511,565	32,051	649,909	52,468	1,603,308	1,073,798	37,397	105,500	1,005,695	124,446
Washington Southern	36	229,234	224,241	613,841	79,873	71,052	7,203	236,224	16,959	411,311	202,530	—1,409	20,774	180,347	11,698
West Jersey & Seashore	356	993,550	2,478,760	3,704,420	468,287	534,088	96,035	1,375,152	78,336	2,551,898	1,152,522	—20,337	120,580	1,011,605	238,128
Western Ry. of Alabama	133	363,809	289,113	708,260	115,218	127,030	34,513	196,257	34,107	507,125	201,135	68	28,775	172,428	—18,105

Average mileage operated during previous period—[12] 358; [13] 263; [14] 342; [15] 902; [16] 842; [17] 583; [18] 7,345; [19] 1,776; [20] 1,434; [21] 4,705; [22] 1,180; [23] 1,805; [24] 3,915; [25] 404; [26] 3,591; [27] 2,005; [28] 473; [29] 6,019; [30] 1,416; [31] 3,981; [32] 240; [33] 83; [34] 4,732; [35] 3,314; [36] 3,054; [37] 7,089; [38] 35; [39] 3,537; [40] 475. —Indicates Deficits, Losses and Decreases.

Railway Officers.

Executive, Financial and Legal Officers.

George O. Lilley has been elected treasurer of the Louisiana Railway & Navigation Company, with headquarters at Shreveport, La.

Charles H. Morey, vice-president of the Manistee & Grand Rapids at Manistee, Mich., has been appointed receiver of that company.

R. Lancaster Williams, of Middendorf, Williams & Company, has been elected president of the Georgia & Florida, succeeding his brother John Skelton Williams, of Richmond, Va.

W. M. Baugh has been appointed auditor of the Liberty-White in charge of accounting and freight claim departments, with office at McComb City, Miss., succeeding L. B. Sedgwick, resigned.

F. P. Johnson, auditor of disbursements of the Missouri Pacific and the St. Louis, Iron Mountain & Southern at St. Louis, Mo., has been appointed assistant general auditor, and T. M. Niven succeeds Mr. Johnson.

W. E. Higgins, assistant to general manager of the Lackawanna & Wyoming Valley, at Scranton, Pa., has been appointed acting vice-president and general manager, succeeding Charles F. Conn, vice-president and general manager, resigned to accept service elsewhere.

The following appointments went into effect January 31 on the Southern Pacific: A. D. McDonald, auditor, with headquarters at San Francisco, Cal., was appointed deputy comptroller, succeeding C. B. Seger, resigned; and T. O. Edwards succeeds Mr. McDonald. Hugh Neill was appointed clerk and secretary, succeeding Alex. Millar, resigned. The resignation of William Rockefeller as director and member of the executive committee was accepted, but his place on the Board was not filled. A. D. McDonald, T. O. Edwards and Hugh Neill have been appointed to the same positions on the Southern Pacific of Mexico, as they will hold on the Southern Pacific.

W. H. Penfield, assistant chief engineer of the Chicago, Milwaukee & St. Paul, at Chicago, has been appointed assistant to Vice-President David L. Bush, at Chicago. Mr. Penfield was born in 1874 at Foxburg, Pa., and began railway work in a surveying party on the Buffalo, Rochester & Pittsburgh, in Clearfield County, Penn., and was later resident engineer of the same road to 1899. From August, 1899, to March, 1902, he was resident engineer and locating engineer on the Chicago, Milwaukee & St. Paul, with headquarters at Chicago, and from March, 1902, to December, 1905, he was locating engineer on the Western Pacific in California. From December, 1905, to June, 1911, he was an engineer engaged in the construction of the Puget Sound extension of the Chicago, Milwaukee & St. Paul, with headquarters at Butte, Mont., and in June, 1911, was made assistant chief engineer of the Chicago, Milwaukee & St. Paul, with office at Chicago, which position he held at the time of his appointment on February 1, as assistant to vice-president of the same road as above noted.

Operating Officers.

C. Ludolph, purchasing agent of the Texas & Pacific, has been appointed assistant to the general superintendent with headquarters at Dallas, Tex.

C. B. Carpenter, chief clerk to the assistant general manager of the Denver & Rio Grande, has been appointed inspector of transportation, with headquarters at Denver, Colo., effective February 1.

H. J. Micksch has been appointed assistant superintendent of the Texas & New Orleans and the Galveston, Harrisburg & San Antonio, with headquarters at Jacksonville, Tex., in place of A. L. Kuykendall, resigned.

J. McCraw has been appointed acting superintendent of the Southern division of the Central Vermont, with office at New London, Conn., succeeding W. E. Costello, superintendent at New London, who has resigned.

W. E. Costello has been appointed superintendent of the First division of the Houston & Texas Central, with headquarters at Ennis, Tex., to succeed D. S. Gallagher, who has been granted indefinite leave of absence on account of ill health.

N. W. Jones, trainmaster of the Philadelphia & Reading at Tamaqua, Pa., has been appointed inspector of transportation of the Philadelphia & Reading and subsidiary companies, reporting to the vice-president and general manager, at Reading.

C. S. Wilkins, trainmaster of the Coal & Coke at Gassaway, W. Va., has been promoted to superintendent, succeeding to the duties of J. A. Emmart, assistant general manager at Gassaway, who has resigned to go into other business, and his former position has been abolished. J. W. Morrow, chief train despatcher, succeeds Mr. Wilkins, and J. C. Kinton succeeds Mr. Morrow.

R. M. Johnson has been appointed inspector of transportation of the Western Maryland, with headquarters at Baltimore, Md. H. W. Shank, trainmaster of the Third district, West Virginia division, has been transferred to Cumberland as trainmaster in charge of terminal operation. J. W. Griffey, trainmaster at Elkins, W. Va., of the Second district, West Virginia division, has been transferred to the Third district, succeeding Mr. Shank, and W. D. Peddicord, chief clerk to the superintendent at Cumberland, has been promoted to trainmaster, with headquarters at Elkins, succeeding Mr. Griffey.

H. E. Whittenberger, whose appointment as general superintendent of the Grand Trunk, with headquarters at Toronto, Ont., has been announced in these columns, was born on November 9, 1864, at Peru, Ind., and was educated in the common schools. He began railway work in 1885, with the Wabash as a brakeman and was later conductor in both freight and passenger service until February, 1898, when he went to the Grand Trunk as trainmaster at Stratford, Ont., and later was transferred to London. From May 15, 1902, to October, 1904, he was superintendent of the Denver & Rio Grande at Alamosa, Colo., and at Pueblo. He went to the Cincinnati, Hamilton & Dayton in November, 1904, as superintendent at Indianapolis, Ind., remaining in that position until his appointment on January 1, 1906, as superintendent of the Kansas City Southern, at Pittsburg, Kan. In October, 1907, he returned to the service of the Grand Trunk as superintendent, which position he held at the time of his recent appointment as general superintendent of the Ontario lines of the same road, as above noted.

H. E. Whittenberger.

P. C. Hart, general superintendent of the Chicago, Milwaukee & Puget Sound at Seattle, Wash., has been appointed general manager of the Chicago, Milwaukee & St. Paul lines East of the Missouri river, with headquarters at Chicago. J. T. Gillick, superintendent at Aberdeen, S. D., has been appointed assistant to general manager, with office at Chicago. G. E. Simpson, superintendent of transportation, has been appointed general supervisor of transportation, and G. L. Whipple, heretofore assistant superintendent of transportation, has been appointed superintendent of transportation, both with offices at Chicago, effective February 1.

C. G. Bowker, whose appointment as general superintendent of the Eastern lines of the Grand Trunk, with headquarters at Montreal, Que., has been announced in these columns, was born on April 21, 1871, at Medford, N. J., and was educated in the public schools of Philadelphia, Pa. He began railway work in May, 1888, with the Philadelphia & Reading as a telegraph operator and was subsequently agent and division operator on that road. From 1892 to 1900 he was first a telegraph operator and then train despatcher on the Lehigh Valley, and since that time has

held the positions of train despatcher, chief despatcher, trainmaster, assistant superintendent and superintendent on the Grand Trunk.

Frank E. Clarity, whose appointment as superintendent of transportation of the Denver & Rio Grande, has already been announced in these columns, was born September 10, 1877, at Sauk Centre, Minn. He was educated in the common schools of Minnesota and began railway work in September, 1894, as a car checker for the Great Northern at Superior, Wis. He remained with that road for eight years, filling various positions in the local freight office including that of local car accountant. He was then for two years car distributer for the Lake district and from November, 1904, to August, 1907, was assistant chief clerk and chief clerk to the general superintendent of transportation with headquarters at St. Paul, Minn. He was made traveling car agent on the latter date and in April, 1911, became chief clerk to the general superintendent of the Western district, with office at Seattle, Wash. He went to the Denver & Rio Grande in March, 1912, as inspector of transportation, which position he held until January 1 this year, when he was promoted to superintendent of transportation, with headquarters at Denver, Colo.

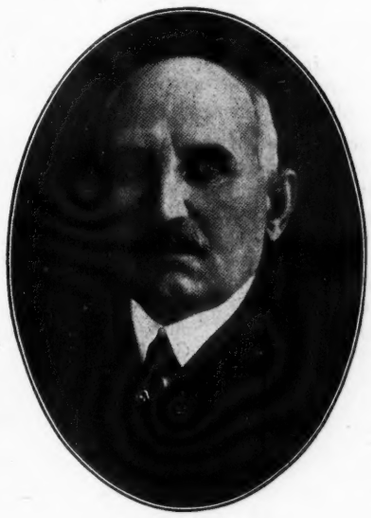
F. E. Clarity.

T. Cushing has been appointed trainmaster of the Third district of the Grand Trunk, with headquarters at Richmond, Que., succeeding R. P. Smallhorn, assigned to other duties; S. L. Trusler, passenger trainmaster at Toronto, has been appointed passenger trainmaster of the Ontario lines, with headquarters at Toronto; W. J. Piggott, trainmaster at Allandale, has been appointed trainmaster of the 11th and 14th districts, including Allandale yard, and W. J. Little, passenger trainmaster at Allandale, has been appointed trainmaster of the 12th district, both with offices at Allandale. The position of passenger trainmaster, Northern division, has been abolished. W. J. Hogan, master of transportation at Durand, Mich., has been appointed trainmaster of the P. O. & N. Railway and district 29 (exclusive of Detroit and Port Huron terminals), with headquarters at Pontiac, and H. W. Matthews, trainmaster at Battle Creek, has been appointed passenger trainmaster of the Western lines, including districts 25, 26, 27, 28, 29 and P. O. & N. Railway, with headquarters at Durand.

Benjamin McKeen, who recently became general manager of the Pennsylvania Lines West of Pittsburgh, with office at Pittsburgh, Pa., was born at Terre Haute, Ind., on January 23, 1864. He attended Worcester Polytechnic at Worcester, Mass., during 1881 and 1882, and was graduated from Rose Polytechnic Institute in 1885 as a mechanical engineer. He began railway work in September, 1885, as a draftsman in the office of superintendent of motive power and machinery of the Terre Haute & Indianapolis, now a part of the Vandalia Railroad, at Terre Haute. He held various minor positions in the motive power and engineering departments until January 1, 1887, when he was appointed engineer maintenance of way of the Terre Haute & Logansport, now also a part of the Vandalia Railroad. On August 1, 1892, he was transferred to the Peoria division in a similar capacity, and was promoted to superintendent of that division January 5, 1894. He was made superintendent of the main line division in June, 1901, and on April 1, 1902, became superintendent of the Chicago Terminal division of the Pennsylvania Lines West of Pittsburgh, with office at Chicago. In December of the following year he returned to the Vandalia as general manager, with headquarters at St. Louis, Mo., which position he held until his recent appointment as general manager of the Pennsylvania Lines West, as above noted.

H. F. Coyle, assistant superintendent of the Grand Trunk, Eastern lines at Bellevue, Ont., has been appointed superintendent of the Belleville division (districts 5, 6, 7, 8, 9 and 10) with headquarters at Belleville; J. J. Connolly, assistant superintendent at Montreal, Que., has been appointed superintendent of the Montreal division (districts 1, 2, 3 and 4) with headquarters at Montreal; R. W. Scott has been appointed superintendent of Montreal terminals, with headquarters at Montreal; L. Harold, assistant trainmaster at Hamilton, Ont., has been appointed superintendent of transportation of the Eastern lines, with headquarters at Montreal; C. S. Cunningham, superintendent Western lines at Detroit, Mich., having resigned, J. Caldwell has been appointed superintendent of the Detroit division; including Durand terminals, districts 27, 28, 29 and P., O. & N. Railway, with headquarters at Detroit; J. Ehrke, assistant superintendent at Battle Creek, has been appointed superintendent of the Chicago division, including districts 25 and 26, with headquarters at Battle Creek; O. F. Clark, trainmaster at Pontiac, has been appointed superintendent of transportation of Western lines, including districts 25, 26, 27, 28, 29 and P., O. & N. Railway, with direct supervision over all matters pertaining to transportation, and the office of master of transportation has been abolished.

E. W. Batchelder, whose appointment as assistant general manager of the Erie lines west of Buffalo, N. Y., and Salamanca, with headquarters at Cleveland, Ohio, has been announced in these columns, began railway work in 1870 as a telegraph operator on the La Crosse division of the Chicago, Milwaukee & St. Paul and from 1873 to 1879 was chief train despatcher of the Chicago division of the same road. He went to the Wabash in 1880 as train despatcher at Springfield, Ill., and later in the same year returned to the service of the Chicago, Milwaukee & St. Paul as chief despatcher and was then assistant superintendent on the River division. He left that company in 1889 to become chief clerk to the general superintendent of the Great Northern at St. Paul, Minn., and was later appointed assistant superintendent of the Fergus Falls division at St. Cloud, and then until 1895, was superintendent of the Montana division at Havre, Mont. He was out of railway work from 1895 until he went to the Erie, in June, 1903. The following December he was appointed superintendent of the Meadville division, and in November, 1912, was made assistant general superintendent at Marion, Ohio, which position he held at the time of his recent appointment as assistant general manager of the same road as above noted.



E. W. Batchelder.

Traffic Officers.

T. M. True has been appointed general freight and passenger agent of the Apalachicola Northern, with office at Port St. Joe, Fla., succeeding J. H. Hodges, resigned.

J. I. Campbell has been appointed commercial agent of the Chicago, Milwaukee & St. Paul, with office at St. Louis, Mo., succeeding H. G. Selby, resigned to accept service with another company.

C. N. McNulty, who recently resigned as soliciting freight agent of the Georgia, Southern & Florida, has been appointed freight soliciting agent of the Southern, with office at New York.

T. L. Jennings has been appointed commercial agent of the Chesapeake & Ohio and the Chesapeake & Ohio of Indiana, with office at Birmingham, Ala., succeeding F. W. Miller, commercial agent at Atlanta, Ga., resigned.

J. P. Rochelle has been appointed traveling freight agent of the Missouri, Oklahoma & Gulf, with headquarters at Dallas, Tex., in place of F. S. Sleight, who has been transferred to Houston, Tex., as commercial agent.

I. W. Dudley has been appointed commercial agent of the Toledo, St. Louis & Western, with headquarters at Seattle, Wash. J. H. Hogg has been appointed live stock agent, with headquarters at East St. Louis, Ill., in place of E. McGraw, resigned.

R. M. Case, chief clerk in the passenger department of the Lake Shore & Michigan Southern, has been appointed assistant general passenger agent of the Lake Shore & Michigan Southern and the Dunkirk, Allegheny Valley & Pittsburgh, with headquarters at Cleveland, Ohio.

The headquarters of A. N. Brown, general traffic manager of the El Paso & Southwestern System and the Morenci Southern Railway, have been transferred from Chicago to El Paso, Tex. The Chicago office will be continued with G. W. Feakins in charge as assistant to general traffic manager.

R. M. Brander has been appointed division freight agent of the Virginia general division of the Chesapeake & Ohio, with office at Richmond, Va., succeeding A. S. Cary, resigned, and C. C. Dearhart, Jr., has been appointed traveling freight agent of the Virginia general division, reporting to Mr. Brander.

George W. Vaux, Canadian passenger agent of the Union Pacific at Toronto, Ont., and formerly general passenger agent of the Grand Trunk, has been appointed general agent of the passenger department of the former road, with headquarters at Chicago. L. F. Barron, local freight agent of the Illinois Central, has been appointed general agent of the freight department of the Union Pacific, with office at Chicago.

In consequence of the recent order of the Supreme Court the Southern Pacific announces that effective February 1 all joint agencies in connection with the Union Pacific will be abolished. The following will represent the Southern Pacific exclusively: R. S. Stubbs, general eastern freight agent, New York; L. H. Nutting, general eastern passenger agent, New York; J. H. Glynn, New England agent; W. B. Johnson, district freight and passenger agent, Baltimore, Md.; F. T. Brooks, district freight and passenger agent, Buffalo, N. Y.; R. J. Smith, district freight and passenger agent, Philadelphia, Pa.; G. G. Herring, general agent, Pittsburgh, Pa.; O. P. Bartlett, general agent, Atlanta, Ga., and Birmingham, Ala.; C. M. Evans, general agent, Cincinnati, Ohio; George B. Hild, general agent, St. Louis, Mo.; E. A. Macon, general agent, Detroit, Mich.; A. G. Little, general agent, Kansas City, Mo.; William K. McAllister, general agent, Denver, Colo.; W. G. Neimyer, general agent, Chicago. On the Pacific coast and in Salt Lake City, Utah, there will be no changes in the representatives.

Engineering and Rolling Stock Officers.

C. T. McElvany has resigned as master mechanic of the Missouri, Kansas & Texas of Texas, at Dennison, Tex.

N. L. Smithan has been appointed assistant superintendent of motive power of the Missouri, Kansas & Texas of Texas, with office at Dennison, Tex.

R. Q. Prendergast has been appointed master mechanic of the Cincinnati, Hamilton & Dayton, with headquarters at Indianapolis, Ind., succeeding W. G. Rose, resigned.

H. E. Holt, division engineer of the Chicago, Milwaukee & St. Paul, at Spokane, Wash., has been appointed assistant chief engineer, with headquarters at Chicago, succeeding W. H. Penfield.

H. D. Jackson has been appointed general master mechanic of the Alabama, Tennessee & Northern and the Tombigbee Valley, with headquarters at Panola, Ala. He is also in charge of the shop at Calvert, Ala.

F. L. C. Bond, resident engineer of the Grand Trunk, at Montreal, Que., has been appointed division engineer of the Eastern lines, with headquarters at Montreal; G. Beckingham, general roadmaster at Montreal, has been appointed superintendent of track, with headquarters at Montreal; J. H. Johnston, resident engineer at Montreal, has been appointed superintendent of bridges and buildings, with headquarters at Montreal; C. S. Ogilvie has been appointed assistant engineer of the Belleville division, with headquarters at Belleville, Ont.; H. Ferguson, general roadmaster at Toronto, has been appointed superintendent of track, Ontario lines; G. A. Mitchell, resident engineer at Toronto, has been appointed superintendent of bridges and buildings, and E. G. Hewson, resident engineer at Toronto, has been appointed division engineer, all with headquarters at Toronto, Ont. The offices of general roadmaster, master of bridges and buildings and resident engineer have been abolished.

M. A. Long, architect of the Baltimore & Ohio, at Baltimore, Md., has been appointed assistant to chief engineer of the Baltimore & Ohio-Cincinnati, Hamilton & Dayton System, with headquarters at Baltimore. Mr. Long was born on October 25, 1875, near Middletown, Ohio, and received his education in the public schools at Dayton, Ohio, and at Middletown, later taking a course in architecture and railroad engineering at the Scranton Schools. He entered the service of the Baltimore & Ohio on June 5, 1899, as architect and assistant on engineering corps, and was promoted to architect on that road in 1904, which position he held at the time of his present appointment as assistant to chief engineer, as above noted. He is a member of the American Society of Civil Engineers, the American Institute of Architecture, and is vice-chairman of the building committee of the American Railway Engineering Association.

M. A. Long.

Purchasing Officers.

H. W. Morris has been appointed purchasing agent of the Wabash Pittsburgh Terminal and the West Side Belt Railroad Company, with headquarters at Rook, Pa.

The office of purchasing agent of the Texas & Pacific, heretofore held by C. Ludolph, has been abolished, and hereafter matters pertaining to the purchasing department will be handled through Vice-President Freeman's office at New Orleans, La.

F. W. Mahl, assistant to director of maintenance and operation of the Southern Pacific, has been appointed director of purchases, succeeding W. V. S. Thorne, resigned. Effective January 31. Mr. Mahl has been appointed to the same position also on the Southern Pacific of Mexico.

OBITUARY.

William R. Jones, formerly assistant superintendent of the Utica & Black River, now a part of the New York Central & Hudson River, died at Carthage, N. Y., on February 4, at the age of 69.

J. T. Mason Barnes, who died on January 28, at his home in Baltimore, Md., was secretary and treasurer of the Western Maryland from 1896 to 1902, and then was assistant secretary and treasurer. On October 16, 1912, he was retired on an annuity.

E. H. B. Cull, division freight agent of the Wabash, with headquarters at Detroit, Mich., died in that city on January 31, aged 49 years. Mr. Cull had been connected with the Wabash at Detroit for 30 years, having been made division freight agent five years ago.

Stephen S. Palmer, president of the St. Louis & Hannibal, the Green Bay & Western, the Ahnapee & Western, the Kewaunee, Green Bay & Western and the Iola & Northern railways, also a director in various banking, gas, electric, insurance and manufacturing companies, with headquarters at New York, died on January 28, at Redlands, Cal., at the age of 60.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

THE PENNSYLVANIA RAILROAD has ordered 80 freight locomotives from the company's shops.

THE NORFOLK & WESTERN has ordered 40 Mallet locomotives from the American Locomotive Company. These locomotives will be equipped with superheaters, will have 22 in. & 35 in. by 32 in. cylinders, 56 in. driving wheels and in working order will weigh 405,000 lbs.

THE SAN ANTONIO, UVALDE & GULF has ordered one consolidation locomotive from the American Locomotive Company. The dimension of the cylinders will be 20 in. by 24 in.; the diameter of the driving wheels will be 54 in., and the total weight in working order will be 144,000 lbs.

CAR BUILDING.

THE BALTIMORE & OHIO has ordered 8 postal cars from the Pullman Company.

THE DONORA SOUTHERN has ordered 50 coal cars from the Standard Steel Car Company.

THE ARMS PALACE HORSE CAR COMPANY will build 12 cars in its own shops, the underframes and trucks to be furnished by the Bettendorf Axle Company.

THE NATIONAL RAILWAYS OF CENTRAL AMERICA, owned by the United Fruit Company, New York, have ordered 20 freight cars from the Ralston Steel Car Company.

THE NEWBURGH & SOUTH SHORE has ordered 125 self-clearing ore cars from the Pressed Steel Car Company, and 50 general service cars from the Ralston Steel Car Company.

THE NORFOLK & WESTERN has ordered 1,000 gondola cars and 250 hopper cars from the American Car & Foundry Company, and 1,000 box cars from the Pressed Steel Car Company.

THE LOUISVILLE & NASHVILLE, mentioned in the *Railway Age Gazette* of January 31, as being in the market for 500 gondola cars, has ordered that equipment from the Mt. Vernon Car & Manufacturing Company.

THE CHICAGO, ROCK ISLAND & PACIFIC has ordered twenty 70-ft. coaches, eighteen 70-ft. chair cars, seven 60-ft. smoking cars, five 60-ft. three-compartment cars, and ten 60-ft. baggage cars from the Pullman Company; all of all-steel construction.

THE DULUTH & IRON RANGE, mentioned in the *Railway Age Gazette* of January 24, as having ordered 800 ore cars from the Standard Steel Car Company, ordered those cars from the Summers Steel Car Company. They will be built by the Standard Steel Car Company.

IRON AND STEEL.

THE WESTERN MARYLAND has ordered 8,400 tons of rails from the Carnegie Steel Company.

THE GREAT NORTHERN has ordered 20,000 tons of rails, divided equally between the Cambria Steel Company, the Bethlehem Steel Company, the Pennsylvania Steel Company, and the Lackawanna Steel Company.

SIGNALING.

The Railroad Commission of Indiana has ordered the Pere Marquette to install automatic block signals between Porter and the Michigan state line, 22 miles, by October 1, next. The same body has ordered the Pittsburgh, Cincinnati, Chicago & St. Louis to install automatic block signals between Richmond and Indianapolis, on 37 miles, and to take similar action in the case of all sections of the line where a single track is converted into double track.

Supply Trade News.

The Paxton-Mitchell Company has received orders for its metallic packing for the piston rods and valve stems on the 246 locomotives recently ordered by the Harriman Lines.

M. J. Madison, formerly assistant superintendent of the Morden Frog & Crossing Company, at Chicago, has been appointed superintendent of the plant of The Weir Frog Company at Cincinnati, Ohio.

The Milwaukee and West Allis properties of the Allis-Chalmers Company were sold by Commissioner Hazelton on February 3, to J. H. McClement of New York, chairman of the reorganization committee, for $2,250,000.

The Orenstein-Arthur Koppel Company, Pittsburgh, Pa., will move its general offices to Koppel, Pa., where its plant is now located. A two-story office building, 100 ft. x 160 ft., is now under construction at Koppel.

Frank N. Grigg, eastern representative of the Adams & Westlake Company, Chicago, for the past ten years, has resigned to become district manager of the Standard Heat & Ventilation Company, Inc., New York, with office at Washington, D. C.

Jordan D. Williams, Indianapolis, Ind., manufacturer and contractor for mastic rock asphalt floors, has received a contract from the Cleveland, Cincinnati, Chicago & St. Louis for about 30,000 sq. ft. of 1½ in. mastic rock floor for a freight house driveway.

S. P. McGough has been appointed general manager of the North American Railway Construction Company, engineers and contractors, with offices at Monadnock block, Chicago. A. S. Littlefield is president of the company; Emmet M. Fry, vice-president, and H. H. McDonald, secretary and treasurer.

A new company, under the name of Littlefield, Fry & McGough, has been incorporated with offices in the Monadnock block, Chicago, to make electric welded joints, as licensees of the Lorain Steel Company. The officers are Emmet M. Fry, president and general manager; S. P. McGough, vice-president, and Arthur S. Littlefield, secretary and treasurer.

M. E. Keig, who has been connected with the Atchison, Topeka & Santa Fe for several years, for the last five years in the purchasing department at Chicago, has accepted a position as secretary-treasurer of Harry Vissering & Co., with offices in the Great Northern building Chicago. Mr. Keig will also represent the Charles R. Long, Jr., Co., of Louisville, Ky.

The Isthmian Canal Commission will receive bids until April 1, 1913, for the purchase of supplies no longer needed. These supplies include steam shovels and parts; locomotives, dump and flat cars and parts; cranes, spreaders and parts; unloaders and parts; ballast plows; rock drills; concrete mixers and parts; injectors and parts; oil cups, lubricators and lubricator parts, etc. Circular No. 758.

W. W. Lavarack has resigned his position as chief engineer of the Federal Signal Company, Albany, N. Y., to become general manager of the American Railway Signal Company, Cleveland, Ohio. Mr. Lavarack, after a number of years experience in the signal field with railroads and manufacturers in England, came to the United States in 1896 and entered the service of the Standard Railroad Signal Company, since which time he has been connected with the Pneumatic Signal Company and the Federal Signal Company, as mentioned above.

O. C. Mann, manager of the Mann-McCann Company, Chicago, writes to the *Railway Age Gazette* as follows:

"I note that the Isthmian Canal Commission is beginning to offer for sale the 21 Mann-McCann and Mann earth spreaders that we built for them and a lot of extras for the same. I think that it is no more than right that the bidders on this equipment should fully understand that these machines were built special, and that their extreme clearance will not allow them to be shipped or used on any railroad on this continent, and that the extras were designed for these particular machines and cannot be used on any other spreader."

The sales of the Western Electric Company, Chicago, during the year 1912 will be between 71 and 72 millions, which is slightly

more than in 1906, the previous largest year in the company's business. The increase has been in American sales outside of the Bell system, which have increased about 100 per cent. over 1906, and in European sales, which were the largest in the company's history. The results have been accomplished in the face of increased and increasing competition. The company is now selling to upwards of 30,000 customers in the United States alone. It is expected that the profits will be satisfactory considering the wider distribution and increased competition. The board of directors has established two additional vice-presidents in the company's organization, and has appointed to these newly-created positions Gerard Swope, general sales manager, and A. L. Salt, general purchasing agent.

John Hoffhine, for nine years assistant chemist of the Union Pacific at Omaha, has accepted an appointment with the American Brake Shoe & Foundry Company, with headquarters at 30 Church street, New York, effective on February 1. Mr. Hoffhine was born in Ohio 31 years ago. Immediately upon graduation from the Ohio State University in 1904 he entered the testing department of the Union Pacific at Omaha, where he soon advanced to the position of assistant chemist, with complete charge of the chemical and physical testing laboratories. He conducted exhaustive tests and analyses of the steel rails of the associated lines, and under the direction of W. R. McKeen, Jr., former superintendent of motive power and machinery, Mr. Hoffhine had charge of the material testing and research work in connection with the Harriman Lines standardization of passenger cars, freight cars and locomotives.

The Burden Sales Company, with general offices at 30 Church street, New York, and branch offices in Chicago, Atlanta, Ga., and St. Paul, Minn., has been organized by Gilbert H. Pearsall, president; H. H. Linton, vice-president; and Craig Graves, secretary and treasurer, to handle with the exception of horseshoes all the products of the Burden Iron Company, of Troy, N. Y., including Burden staybolt iron, Burden engine bolt iron, Burden rivets, etc. In connection with the general offices of the Burden Sales Company will be the eastern sales office of the Jacobs-Shupert United States Firebox Company, Coatesville, Pa., and the Oxweld Railroad Service Company, Chicago. Mr. Pearsall is also vice-president of the two latter companies, as was mentioned in the *Railway Age Gazette* of July 5, 1912, page 35, and August 30, 1912, page 407, respectively. He has recently resigned his position as secretary and manager of sales for Joseph T. Ryerson & Son, Chicago, with office in New York, as mentioned in last week's issue.

Samuel Thomas Park, heretofore superintendent of motive power of the Chicago & Eastern Illinois, at Danville, Ill., has been elected president of the Monarch Pneumatic Tool Company, with headquarters at St. Louis, Mo., succeeding William Miller, who has been made vice-president of the Pyle-National Electric Headlight Company, as previously noted in these columns. Mr. Park was born March 31, 1868, and was educated at Elizabethtown College, Elizabethtown, Ky. He entered railway service in 1883, as clerk to the master mechanic of the Louisville & Nashville at East Nashville, Tenn., and laid the foundation of his career in the mechanical department of that road. From 1893 to 1900 he was a division foreman on the Louisville, New Albany & Chicago, and its successor, the Chicago, Indianapolis & Louisville, and was then for two years division master mechanic of the Santa Fe Pacific at Winslow, Ariz.; for one year division master mechanic of the Southern California at San Bernardino, Cal., and for two years master mechanic on the Illinois Central and Chicago & Eastern Illinois roads at Centralia and at Danville, Ill. On March 10, 1905, he was appointed acting superintendent of motive power of the latter road, and on June 8, 1905, was appointed superintendent of motive power, which position he held until he resigned, effective February 1, to become connected with the Monarch Pneumatic Tool Company.

District Judge Hazel, in the United States district court, for the Southern district of New York, on January 27, handed down a decision in favor of the Union Tank Line in the litigation against the American Car & Foundry Company under the "Center Anchor" patent taken out by John W. Van Dyke. In accordance with this invention the middle of the tank of a tank car is secured to the underframe by rivets and the ends are held down between laterally retaining devices by means which allow the tank to expand longitudinally. The decision was in part as follows: "A reasonable construction of the claims will not permit restricting them merely to a tank body or plates riveted permanently to the underframe. . . . It is a fundamental rule that to constitute infringement it is unnecessary to use the entire device, and that if parts thereof are used in substantially the same way and in a similar contrivance it is infringement." The judge then found that the defendant had appropriated Van Dyke's method of center anchoring by riveting the casing to the shell, and though the method used differed slightly from that of the complainant, such difference was negligible, as the same result was achieved. It was also shown that the defendant's car is allowed free longitudinal expansion, thereby obtaining the precise results described in the claims in controversy. The judge decided that all the claims of the complainant were valid and were infringed by the defendant.

TRADE PUBLICATIONS.

Chicago & North Western.—The passenger department has issued an attractive booklet devoted to the outdoor winter sports at Lake Geneva, Wis.

Pneumatic Tools.—The Chicago Pneumatic Tool Company has issued bulletin No. 124, describing its pneumatic riveting, chipping, calking and stone hammers.

Electric Lighting.—The General Electric Company, Schenectady, N. Y., has issued an attractive illustrated booklet on G. E. Edison "Mazda" lamps for standard lighting service.

Pneumatic Hammers.—The Chicago Pneumatic Tool Company, Chicago, has devoted bulletin No. 124 to its pneumatic riveting, clipping, calking and stone hammers. In addition to descriptions this bulletin includes illustrations, diagrams and complete dimension tables.

Titanium Alloy.—The Titanium Alloy Manufacturing Company, Niagara Falls, N. Y., has published in a small folder specifications to govern the addition of Ferro Carbon-Titanium in the manufacture of both open hearth and Bessemer rails.

Boilers.—The Wm. H. Wood Locomotive Firebox & Tube Plate Company, Media, Pa., has published in a small pamphlet a very favorable report by John W. Harkom, a competent mechanical engineer, on three Wood boilers which had been in service for three years. The pamphlet includes also a study by the same author of the results of tests of Wood boilers by the New York Central & Hudson River.

Denver & Rio Grande.—A comprehensive review of the agricultural, mining, industrial and commercial conditions of Colorado, Utah and New Mexico, is contained in the annual review number of the Railroad Red Book just issued by the passenger department. The book contains a large number of contributed articles on the progress made during 1912 in irrigation, agriculture, mining and manufacture.

Wood Preserving.—The Barry Hardwood Creosoting Company, Kansas City, Mo., has issued an illustrated booklet containing a prospectus of the Barry hardwood creosoting process, which it is claimed will successfully treat hardwood with a preservative that will penetrate the center of the timber within eight or nine hours time. The appliance, while designed particularly for treating hardwood, can be converted by turning a valve for use with a softwood process.

Railway Service in the Balkan War.—According to a recent report from Beirut, the railway systems of the Hedsha Railway and of the French Company have been of the greatest possible assistance to the Turks in their military operations. But for these railways the Turkish authorities could not have got their troops together in so short a time and transported the reserves to the front. The military importance of the Baghdad and Anatolian railways has also been established for the first time. The latter railway was at once placed at the disposal of the military authorities, all passenger and freight traffic being stopped two days. On the other railways the ordinary traffic was not disturbed to any great extent.

Railway Construction.

BOSTON & MAINE.—The Hampden Railroad, 15 miles long, between Springfield, Mass., and Bondville, which is to make a connection for the Boston & Maine by which it will have a route from Boston to Springfield parallel to the Boston & Albany and about the same length as the B. & A., is to be finished, according to announcements of the company, by the first of May. The Boston & Maine is to put in stronger bridges in place of those on the Central Massachusetts division so as to permit the running of heavier locomotives through from Boston to Springfield.

CANADA & GULF TERMINAL.—An officer writes, regarding the report that work is now under way on the extension from Matane, Que., east to Gaspe Basin, about 160 miles, that the surveys are all completed. It has not yet been decided when the work will be carried out. (April 19, p. 940.)

CANADIAN PACIFIC.—Sir Thomas G. Shaughnessy, president of this company, is quoted as saying that the new work on the western division for the present year includes the finishing up of some 300 miles of new line and building 500 miles additional. The plans include also the building of a tunnel five miles long in the Selkirk mountains.

EL PASO & SOUTHWESTERN.—An officer writes that there is no truth in the report that an extension is to be built south of Nacozari, Mexico, on the Nacozari Railroad. Surveys are only being made for the elimination of a few sharp curves on the present line.

HAMPDEN RAILROAD.—See Boston & Maine.

KENTUCKY SOUTHWESTERN ELECTRIC RAILWAY LIGHT & POWER COMPANY.—An officer writes that the company expects to begin work on a section of this line early this spring. The plans call for building from Henderson, Ky., southwest via Paducah, Mayfield and Murray to Hickman, in all about 210 miles. The work on the first section of 57 miles will be easy, and includes about 889,140 cu. yds. excavation work, and 135,550 cu. yds. of embankment The maximum grades will not exceed 1 per cent., and the maximum curvature 8 deg. There will be one steel bridge 600 ft. long, a 4,662-ft. trestle, also 11 small stations and 3 sub-stations. H. C. Rhodes, president, and W. A. Calhoun, chief engineer, Paducah. (January 31, p. 230.)

MOBILE & EASTERN SHORE.—Under this name a company is being organized in Alabama, to build from Montrose Park, Ala., south to a point below Point Clear, about 20 miles. J. K. Glennon & Company, Mobile may be addressed.

MONONGAHELA VALLEY TRACTION.—An officer writes regarding the building of extensions to Salem, W. Va., to Lumberport and to Annabell, that surveys have been made for the first two lines and that they will be built, if the company is able to secure the right of way. Bids for grading will probably be asked for about April 1. The lines are to be laid with 80-lb. rails and bracket overhead construction will be used. J. O. Watson, general manager, Fairmont, W. Va.

NORTHERN PACIFIC.—According to press reports work has been started on an extension of the Clark's Fork branch from Bridger, Mont., south to Chance, about 20 miles.

ORANGE & NORTHEASTERN.—According to press reports a contract has been given M. Tansey for grading work on a section from Vinton, La., north. The company was organized last year in Texas, with headquarters at Orange, to build from White City, San Augustine county, Tex., east to a point on the Sabine river; also to build a 14-mile line from Orange, Tex., to Nibletts Bluff, La., in all 126 miles. E. Kennedy, president; H. White, assistant general manager, Orange. (September 6, p. 453.)

PENNSYLVANIA RAILROAD.—An officer writes that contracts have been let for piercing the three tunnels on the Allegheny division as follows: For the tunnel at East Brady, Pa., to be 2,660 ft. long, and for the tunnel at Wood Hill to be 2,870 ft. long, to Arthur McMullen, New York; for the third tunnel at Kennerdell, to be 3,350 ft. long, to the John A. Kelly Company, Philadelphia, Pa. (January 31, p. 331.)

QUANAH, ACME & PACIFIC.—Announcement has been made that this company which is building an extension from Paducah, Texas, west to Roaring Springs in Motley county, about 40 miles, will start work on the extension projected for some time across the Panhandle of Texas and through eastern New Mexico to Roswell, 300 miles, as soon as the line is finished to Roaring Springs. It is said that three routes are under consideration, one via Plainview, another via Lubbock and the third via Tahoka. The Q., A. & P. is being constructed largely by St. Louis capital. Sam Lazarus of St. Louis, Mo., is president and R. D. Yoakum, also of St. Louis, is third vice president of the road. (November 15, p. 973.)

WASHINGTON ELECTRIC.—According to press reports three important links in a chain of electric railways that will eventually connect Portland, Ore., with the principal cities on Puget Sound will be built this year at a cost of $2,000,000. A $10,000,000 mortgage has been filed in the state of Washington by the company to secure a 25-year 6 per cent bond issue, of which $2,000,000 will be issued for immediate development. The plans call for building lines as follows: From a connection with the line from Vancouver, Wash., at a point near Orchards, Wash., north to the Lewis river, 20 miles; from the present southern terminus of the line from Chehalis, to the Cowlitz river; from the northern terminus of the line from Centralia, to Olympia, 26 miles. In addition a new line is to be built from Vancouver east to Camas, but this will not form a part of the Portland-Tacoma line. When these improvements are completed there will remain a gap of about 50 miles between the Cowlitz and the Lewis rivers. A connecting line over this 50 miles will be built, also a connection between Olympia and Tacoma will be made to complete the through line between Portland and Puget Sound. H. C. Coffman is president, Chehalis, and A. Welch is general manager, Portland. (September 13, p. 491.)

WESTERN CANADA.—Incorporation has been asked for in Canada to build from Fort Churchill, on Hudson's Bay, south through Manitoba, south of the Churchill river and north of the Nelson river to a point at or near Sea Falls, on Nelson river, thence north of Lake Winnipeg and thence west via Prince Albert, Sask., to Calgary, Alb., with branch from a point near Manitoba Lake, Sask. Vincent, Seguin & Labelle, Ottawa, are solicitors for the applicants.

RAILWAY STRUCTURES.

BALTIMORE, MD.—An officer of the Pennsylvania Railroad writes that arrangements have been made to replace the present double track steel truss bridge 513 ft. long, with a four track reinforced concrete arch viaduct of three spans, to have a total length of 606 ft. on the Maryland division of the Philadelphia, Baltimore & Washington over Gwynn's Falls and the Western Maryland Tidewater Railroad in Baltimore. A contract for the work, which will require about 25,000 cu. yds. of concrete and 800,000 lbs. of steel bars for reinforcement, has been given to Charles McDermott, Pennsylvania building, Philadelphia, Pa.

CLEVELAND, OHIO.—The Baltimore & Ohio has announced plans for expenditures in Cleveland that will cost approximately $1,000,000, including two large freight houses, a large storage building, and additional yard and side track facilities.

SHREVEPORT, LA.—The Houston & Shreveport has let a contract for the construction of a new roundhouse to R. B. Shearer, of Lufkin, Tex.

TEXAS.—The Gulf, Colorado & Santa Fe has announced that $1,500,000 has been appropriated for improvements in Texas during this year as follows: Shops, engine houses and turntables, $260,000; siding and spur tracks, $230,000; water and fuel stations, $160,000; terminal yards, $140,000; station buildings and fixtures, $125,000; track fastenings and appurtenances, $115,000; increased weight of rail, $80,000; right of way and station grounds, $50,000; bridges, trestles and culverts, $50,000; additional main tracks, $40,000; block and other signal apparatus, $38,000; telegraph and telephone lines, $28,000; shop machinery and tools, $26,000; protection of banks and drainage, $25,000; dock and wharf properties, $21,000; fencing right of way, $20,000; ballasting, $20,000; improved frogs and switches, $5,000; interlocking plants, $1,500; miscellaneous additions and betterments, $39,000.

Railway Financial News.

BOSTON & LOWELL.—Merrill, Oldham & Company offered on January 27, $1,000,000 4½ per cent. refunding bonds, due February 1, 1933, at a price yielding about 4.30 per cent.

BRUCE MINES & ALGOMA.—This company will apply at the next session of the Ontario legislature for authority to change its name to the Lake Huron & Northern Ontario, and also to increase the authorized stock from $300,000 to $12,000,000. This road now runs from Bruce Mines, Ont., to Rock Lake Mines, 17 miles.

CHICAGO & NORTH WESTERN.—This company has called for payment at the Farmers Loan & Trust Company, New York, $107,000 5 and 6 per cent. sinking fund bonds of 1879 at 105 and accrued interest to February 1, 1913.

CHICAGO, BURLINGTON & QUINCY.—This company has called for payment at par and interest at the New England Trust Company, Boston, Mass., $109,200 Denver extension sinking fund 4 per cent. bonds, dated December 1, 1881-February 1, 1922.

DULUTH, SOUTH SHORE & ATLANTIC.—This company has sold to William A. Read & Co., New York, $310,000 4½ per cent. equipment notes, series 12, dated December 1, 1912, and due $31,000 semi-annually beginning June 1, 1917. These notes represent part cost of 400 ore cars, the total cost of which was $391,750, the balance paid in cash. These notes are guaranteed by the Canadian Pacific.

GREEN BAY & WESTERN.—The directors have declared a distribution of 1¼ per cent. on the $7,000,000, class B, debentures, comparing with ½ of 1 per cent. paid in February, 1912, and 1911. The arrangement is that after 5 per cent. has been paid on both the stock and the series A debentures, the surplus is to be distributed pro rata to the holders of the B debentures.

LAKE HURON & NORTHERN ONTARIO.—See Bruce Mines & Algoma.

MINNEAPOLIS & ST. LOUIS.—F. J. Lisman & Co., New York, are recommending the purchase of the new 6 per cent. secured notes at 98½ and interest, yielding 7½ per cent. These notes are dated February 1, 1913, and due February 1, 1914, but are redeemable at par and interest at 60 days' notice. Of this issue, $3,000,000 are authorized and outstanding.

This company has also sold to bankers $1,000,000 4 per cent. bonds to retire $1,000,000 5 per cent. notes which matured February 1. The bonds sold include a block of the refunding and extension 4 per cent. bonds, of which $75,000,000 were authorized under date of January 1, 1912.

NEW YORK, ONTARIO & WESTERN.—The New York Public Service Commission, Second district, has authorized this company to issue $1,980,000 4 per cent. bonds to be sold at a price to be fixed hereafter. The proceeds are to be used for the payment of bills payable incurred for capital expenses to the amount of $1,571,564. The balance is to be spent on maintenance of way and equipment. This company is also authorized to issue $900,000 4½ per cent. equipment trust certificates, $30,000 of which are to mature semi-annually up to and including March 1, 1928. The proceeds are to be used for the purchase of 500 coal cars, 300 box cars, 100 flat cars, 50 stock cars and 50 refrigerator cars.

NORFOLK & WESTERN.—Stockholders of record February 17 will be permitted to subscribe before March 25, at 102½ for about $19,000,000 new 4½ per cent. convertible 25-year debenture bonds, dated September 1, 1913, up to 15 per cent. of their holdings. Subscriptions will be payable either in full on or before March 25, or 52½ per cent. on March 25, and 50 per cent. between September 2 and September 5. The bonds will be convertible any time after September 1, 1913, and before September 1, 1923. They are redeemable at 105 and interest any time after September 1, 1923.

PITTSBURGH & SHAWMUT.—This company has sold to Rhoades & Company, New York, and the Guaranty Trust Company, New York, $200,000 5 per cent. equipment trust notes, dated November 1, 1912, maturing in 20 semi-annual instalments. The proceeds will be used to pay for 250 hopper cars.

PITTSBURGH, MCKEESPORT & WESTMORELAND.—Receiver James B. Secrist will by order of the court of common pleas of Allegheny county, Pa., offer the property at public sale at the court house in Pittsburgh on February 25, upset price $60,000. The purchaser will take the property subject to the lien of the mortgage of the Pittsburgh & Westmoreland Railway to the Union Trust Company of Pittsburgh, dated August 1, 1904, and also that of the Pittsburgh, McKeesport & Westmoreland to the Harrisburg Trust Company assigned to the Columbian Trust Company of New York, dated December 1, 1908, under which there are $437,000 bonds outstanding. The $50,500 receiver's certificates, the interest accrued thereon and the cost and expenses of the receivership will be paid out of the proceeds of the sale.

QUEBEC CENTRAL.—Holders of 7 per cent. income bonds and 3 per cent. second debenture stock are informed that the company has created £338,000 ($1,690,000) second mortgage debenture stock and £338,000 ($1,690,000) sterling 5 per cent. third mortgage bonds. Interest in both cases is payable in London on January 15 and July 15, and the principal is redeemable at the expiration of 50 years, the issues constituting a second or third mortgage respectively on the undertaking next after the 4 per cent. first mortgage debenture stock, secured by the rental payable by the Canadian Pacific, and principal and interest guaranteed by that company. Holders of existing 3 per cent. second debenture stock or 7 per cent. income bonds are required to surrender them on or before February 17 for exchange. The basis of exchange is as follows: The old 4 per cent. debenture stock remains undisturbed, but certificates must be presented for exchange into new certificates setting forth the terms of guarantee of principal and interest by the Canadian Pacific. The old 3 per cent. second debenture stock is replaced dollar for dollar by new 3½ per cent. second mortgage debenture stock, principal and interest guaranteed by the Canadian Pacific. The old 7 per cent. income bonds are replaced dollar for dollar by 5 per cent. third mortgage bonds, the principal and interest guaranteed by the Canadian Pacific; a bonus of 10 per cent. will be paid to holders on making the exchange. The old capital stock is converted into stock transferable in sums of $5 and multiples thereof with a dividend of 4 per cent. a year until July 15, 1916, and 5 per cent. thereafter guaranteed by the Canadian Pacific.

SCOTT CITY NORTHERN.—The suit which was brought against this company, as mentioned in the *Railway Age Gazette* of January 24, has been dismissed, and W. H. Wagner, the unfriendly receiver, has been discharged.

SOUTHERN PACIFIC.—William Rockefeller has resigned as director and member of the executive committee of this company.

See item in regard to the Harriman Lines' dissolution plan in General News.

TORONTO, HAMILTON & BUFFALO.—William A. Read & Co., New York, have sold at prices to yield 4¾ per cent. the entire new issue of $1,500,000 4½ per cent. equipment notes, series A, dated February 1, 1913, and maturing in 20 semi-annual payments of $75,000 each, August 1, 1913, to February 1, 1923.

UNION PACIFIC.—See item in regard to the Harriman Lines' dissolution plan in General News.

WABASH PITTSBURGH TERMINAL.—The Guaranty Trust Company, of New York, the Bankers Trust Company and Sutro Brothers & Company, of New York, are placing at par and interest the entire new issue of $973,000 6 per cent. receivers certificates dated February 1, 1913, and due February 1, 1914, but callable at par and interest.

WABASH RAILROAD.—Judge Sanborn, in the United States District Court at St. Louis, on January 30, on application of Pierce & Greer, of New York, representing the Equitable Trust Company of New York, trustee under the first refunding and extension mortgage, appointed a master to hear evidence and determine methods of foreclosure of the mortgage in the pending proceedings preparatory to the order of the sale thereunder.

The receivers on January 30 applied to the court in St. Louis for permission to extend for 6 months the company's obligation in respect to the Wheeling & Lake Erie defaulted notes due February 1, amounting on June 30, 1912, to $9,807,958.